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Figure 1-1. Radiac Set AN/PDR-63

SECTION 1

GENERAL INFORMATION

1-1. SCOPE.

This technical manual comprises instructions for the Radiac Set, AN/PDR-63. The purpose of this manual is to provide information necessary for the proper operation, maintenance and calibration of Radiac Set, AN/PDR-63.

This technical manual is in effect upon receipt. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

1-2. GENERAL DESCRIPTION.

The Radiac Set, AN/PDR-63 (Figure 1-1) is a portable, battery operated, modular-type radiac consisting of:

a. A high range radiacmeter for gamma detection over three ranges, 0-1000, 0-100 and 0-10 rad/hr.

b. A cable connected skin dose probe which when attached to the high range unit measures the radiation dose absorbed by the sensitive layer of the skin over two ranges, 0-5000 and 0-500 rad/hr.

c. A cable connected low range module with probe which when attached to the high range unit measures gamma and indicates beta radiation on four ranges, 0-1000, 0-100, 0-10, and 0-1 mrad/hr.

d. A headset, connected to the low range module, provides the operator with aural indications of radiation intensities when monitoring with the low range auxiliary.

e. A battery charger which charges the 4 rechargeable nickel cadmium size AA (penlight) cells from either 115V, 60 cycle or 24V DC source.

f. Individual nylon pouches for each detection module which enable the operator to attach the high range unit and either the skin dose or low range accessory to a web belt.

g. A carrying case which houses the individual modules in their pouches and provides space for 8 batteries.

1-3. DESCRIPTION OF UNITS.

a. High Range Radiacmeter, IM-226/PDR-63 - The basic high range module measures gamma doserate on three essentially linear scales, 0-1000, 0-100, and 0-10 rad/hr. The instrument utilizes a recycling ion chamber detector system, the output of which is a pulse rate proportional to the incident radiation doserate. A simple integrating circuit converts the pulse rate to a direct current which drives a microammeter calibrated in rad/hr. Power is supplied by four size AA, rechargeable nickel-cadmium cells in a series parallel arrangement providing 2.5 volts input. The high-range module supplies the primary battery power, range switching and readout circuitry for both accessory probes.

b. Skin Dose Accessory, DT-508/PDR-63 - The skin-dose probe measures skin-dose rate on two ranges, 0-500 and 0-5000 rad/hr. The probe is designed to simulate the absorption characteristics of human skin to beta and gamma radiations. It consists of a composite Mylar-aluminum-polystyrene window. An electrometer tube is enclosed; and, when switched into operation, the probe replaces the internal detector in the high-range recycling circuit.

Electrically, the probe is similar to the gamma detector, except that an adjustable capacitor is included for calibration.

When properly used, this probe can extend the deep-dose (gamma) capability of the instrument to 5,000 rad/hr; the operator may discriminate between response from skin-dose or deep-dose by covering the window. Since there is no lead foil shielding the probe, the response to low photon energies will be somewhat different from that of the gamma detector.

c. Low Range Accessory, DT-507/PDR-63 - The low-range accessory measures gamma and indicates beta radiation on four ranges: 0-1, 0-10, 0-100, and 0-1000 mrad/hr. The accessory is packaged in two parts: (1) A probe unit which contains a thin-walled, end-window Geiger-Mueller (GM) tube and associated circuitry; and (2) A power supply unit which converts the 2.5 V battery power to the high voltages necessary for the GM tube and probe circuitry. Both side and end "beta windows" are provided on the probe to facilitate personnel and equipment monitoring. The GM tube detector is operated in the normal "dc" mode on the lower two ranges and in the "pulsed" mode on the upper two ranges. The output of the accessory is in the form of pulses; these pulses are metered by the ratemeter circuit in the basic high-range module. The output pulse rate may also be monitored with the headphones supplied with the radiac set.

d. Headset, H-43B/U - If aural indication of radiation intensities is desired when monitoring with the low range accessory, the headset is connected to the BNC jack on the low range auxiliary top panel. The headset may be worn under a standard battle helmet.

e. Battery Charger, PP-6597/PDR-63 - The battery charger is designed to recharge the four nickel-cadmium cells used in the AN/PDR-63 in 36 hours or less. The charger may be operated from either a 115 V, 60 Hz ac line or a nominal 24 V dc

source (e.g., military vehicle storage battery). The batteries may be left on charge for extended periods (months) without damage. Two sets of batteries are supplied with each radiac so that one set will always be available for use while the other set is on charge.

f. Carrying Harness - Vinyl impregnated, nylon carrying pouches are provided for the high-range, skin-dose and low-range modules and are designed to permit each or all to be suspended from a military cartridge or a web holster belt. Appropriate cut outs permit complete instrument operation and observation.

g. Carrying Case, CY-7058/PDR-63 - The aluminum carrying case provides compartmented stowage of the individual modules in their pouches and also stores 8 batteries and the instruction manual

1-4. REFERENCE DATA.

Table 1-1 contains a tabulation of reference data for the Radiac Set, AN/PDR-63.

TABLE 1-1. CHARACTERISTICS

ITEM	UNIT	CHARACTERISTICS
Operating Range	High Range	0-1000, 0-100, 0-10 rad/hr gamma
	Skin Dose	0-5000, 0-500 rad/hr beta or gamma
	Low Range	0-1000, 0-100, 0-10, 0-1 mrad/hr gamma, beta detection (window open)
Accuracy	High Range	±20% of true dose rate for gamma energies from 80 kev to 1.33 mev.

TABLE 1-1. (Continued)

ITEM	UNIT	CHARACTERISTICS
Accuracy	Skin Dose	±20% of true dose rate for Cesium 137.
	Low Range	±20% of true dose rate on 0-1000 and 0-100 mrad/hr ranges and ±40% of true dose rate on 0-10 and 0-1 mrad/hr ranges for gamma energies from 80 kev to 1.33 mev.
Detectors	High Range	Sealed, pressurized, argon fill, recycling ion chambers (replaceable)
	Skin Dose	Sealed, recycling ion chamber(not replaceable)
	Low Range	Geiger-Mueller (GM) tube (replaceable) pulsed operated on 0-1000 and 0-100 mrad/hr ranges, d.c. operated on 0-10 and 0-1 mrad/hr ranges.
Power (operating)	High Range only	Four sealed, rechargeable nickel-cadmium cells size AA for approximately 30 hrs of operation at 20°C.

TABLE 1-1. (Continued)

ITEM	UNIT	CHARACTERISTICS
Power (charging)	Battery Charger	115V, 60 cycle a.c. or 24 V d.c. for series charging of 4 cells in approximately 36 hrs.
Temperature	All Units	-40° C to +60° C (reduced battery life at cold temperatures).

1-5. EQUIPMENT SUPPLIED.

A complete list of accessories comprising Radiac Set AN/PDR-63 is given in Table 1-2.

1-6. EQUIPMENT REQUIRED BUT NOT SUPPLIED

A list of equipment required for calibration and maintenance is given in Table 1-3.

1-7. FACTORY OR FIELD CHANGES.

No factory or field changes have been made in the Radiac Set, AN/PDR-63.

1-8. EQUIPMENT SIMILARITIES.

Many similarities exist with present Navy radiac equipments. The important characteristics are outlined in Table 1-4. Other than the theory of operation of G-M tubes, this manual does not apply to any other set.

TABLE 1-2. EQUIPMENT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (in)			VOLUME (cu in)	WEIGHT (lbs)
	NAME	DESIGNATION	HT.	WIDTH	DEPTH		
1	High Range Radiacmeter and Pouch	IM-226/PDR-63	4-1/8	2-14	5-13/16	52	2-1/8
1	Skin Dose Accessory and Pouch	DT-508/PDR-63	7/8	2-7/32	5-23/32	17	9/16
1	Low Range Accessory with Probe and Pouch	DT-507/PDR-63 Probe	2-1/4 9-1/4	2-9/16 1-3/8 dia.	5-21/32	41	1-1/4 13/16
1	Battery Charger	PP-6597/PDR-63	4-15/16	1-1/2	1-1/2	11.5	3/4 w/batt.
1	Headset	H43B/U	2-1/8	7	6-1/8	—	7/8
1	Carrying Case	CY-7058/PDR-63	8-5/8	12	8-1/2	790	5-1/4

TABLE 1-2. (Continued)

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (in)			VOLUME (cu in)	WEIGHT (lbs)
	NAME	DESIGNATION	HT.	WIDTH	DEPTH		
4	Nickel-Cadmium Batteries	Size AA	9/16 DIA X 2 LG			—	—
2	Technical Manuals	NAVSHIPS 0000-000-0000					

TABLE 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	DESIGNATION		
1	Electronic Voltmeter	AN/USM-116	Trouble shooting and maintenance procedures	0-25 VDC 0-250 VDC 0-1000 VDC
1	Oscilloscope	AN/USM-105A	Trouble shooting and maintenance procedures	5 MHZ bandwith 1, 10 meg input
1	Radioactive Source	AN/UDM-1A	Calibration	100 r/hr at a distance to enable beam coverage of the high range and skin dose detectors.
1	Pulse Generator		Secondary Calibration and Trouble shooting	0-100 pps pos. or neg. polarity, 0-10 V amplitude

TABLE 1-4. EQUIPMENT SIMILARITIES

RADIAC EQUIPMENT	GAMMA RANGES	BETA CAPABILITY	BATTERY COMPLEMENT
AN/PDR-32	0-5, 50, 500, r/hr	None	2-BA-30
AN/PDR-27 A, B, & C	0-0.5, 5, 50, 500 mr/hr	0-0.5 5 mr/hr.	1-BA-416/U 1-BA-413/U 2-BA-401/U
AN/PDR-27CY	0-0.5, 5, 50, 500 mr/hr	0-0.5, 5 mr/hr	8-BA-30
AN/PDR-27J	0-0.5, 5, 50, 500 mr/hr	0-0.5, 5 mr/hr	6-BA-30
AN/PDR-66	0-0.5, 5, 50, 500 mr/hr	0-0.5, 5 mr/hr	6-BA-30
AN/PDR-63	0-1000, 100, 10 rad/hr 0-5000, 500 rad/hr 0-100, 100, 10, 1 mrad/hr	0-5000, 500 rad/hr 0-1000, 100, 10, 1, mrad/hr	4 Type AA Nickel-Cadmium Rechargeable

1-9. PREPARATION FOR RESHIPMENT.

To prepare Radiac Set, AN/PDR-63 for reshipment, remove the 4 batteries from the High Range unit and place them into their receptacles in the carrying case. Close the end window cover on the low range probe. Insert the High Range, Skin Dose and Low Range units into their pouches and stow in their respective compartments. Place the manuals, Headset and Battery Charger unit in their respective compartments in the cover of the carrying case. Close and secure the case hasps.

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING

Only normal precautions are required in unpacking or handling Radiac Set, AN/PDR-63.

2-2. POWER REQUIREMENTS

a. Operating - Radiac Set AN/PDR-63 is powered by 4 size AA nickel cadmium rechargeable batteries which when properly inserted in the High Range unit are connected in a series - parallel arrangement to provide a constant 2.5 volts for operation of the unit and the Skin Dose or Low Range accessories.

b. Recharging - Spent batteries are recharged in the Battery Charger unit which requires either 110 V, 60 Hz or 24 VDC source voltage. Source power requirements are negligible.

2-3. INSPECTION AND ADJUSTMENT

Inspect Radiac Set AN/PDR-63 to see that all equipment and materials listed in Table 1-1 have been received and that no mechanical damage has occurred in shipment.

a. Batteries - Since there can be no assurance as to the amount of charge remaining in any cell, it is considered necessary to initiate a charging cycle. Proceed as follows:

(1) Unscrew the battery charger cover screw, withdraw the battery cradle and insert four cells from the carrying case. Observe correct polarity as shown in Figure 2-1. It is not necessary to close the unit unless severe moisture is present.

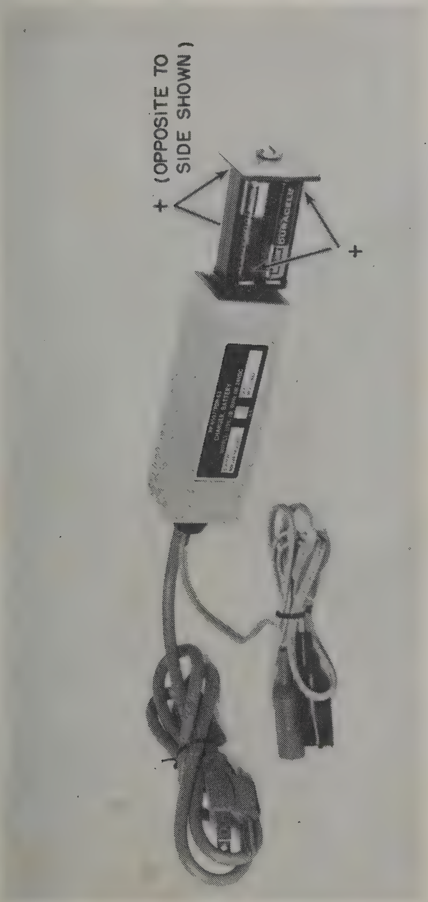

Figure 2-1. Insertion of Batteries in Charger

(2) Connect either the line cord to a 110 V, 60 Hz grounded outlet or the two alligator (battery) clips to a 24 V d.c. source. Red is positive.

(3) Allow 36-hours for a complete charge. The batteries will not be damaged if left on charge indefinitely.

(4) Stored at room temperature, a cell will retain about 70 percent of its charge after 30-days and about 50 percent of its charge after 60-days.

b. Installation for Operation - Remove the battery compartment cover from the High Range unit and install four charged cells. Observe indicated polarity. Refer to Figure 2-2. With one set of batteries installed for operation, recharge the remaining 4 cells. Advance the Selector switch from OFF as follows:

(1) BATT and check for full scale indication.

(2) 0-1000 rad/hr and then through all the remaining eight positions to check for smooth operation and scale drum alignment. Assuming the absence of radiation, the High Range radiacmeter should read zero on the 0-1000, 0-100 and 0-10 rad/hr ranges. With no accessories attached, the Skin Dose and Millirad/hr ranges will also read zero.

(3) Depress the ILLUM switch on any range and check for meter illumination.

(4) Remove the protective cap from P1 and check for the ability to properly connect either the Skin Dose or Low Range accessory. In the absence of radiation, the Skin Dose ranges of 0-5000 and 0-500 rad/hr will also read zero. Likewise, for the Low Range ranges of 0-1000, 0-100 and 0-10 mrad/hr. However, in the 0-1 mrad/hr range occasional or background radiation will cause random upscale indications on the meter.

(5) Connect headset H-43B/U to the Low Range accessory and listen for audible clicks due to background radiation while operating on the low ranges.

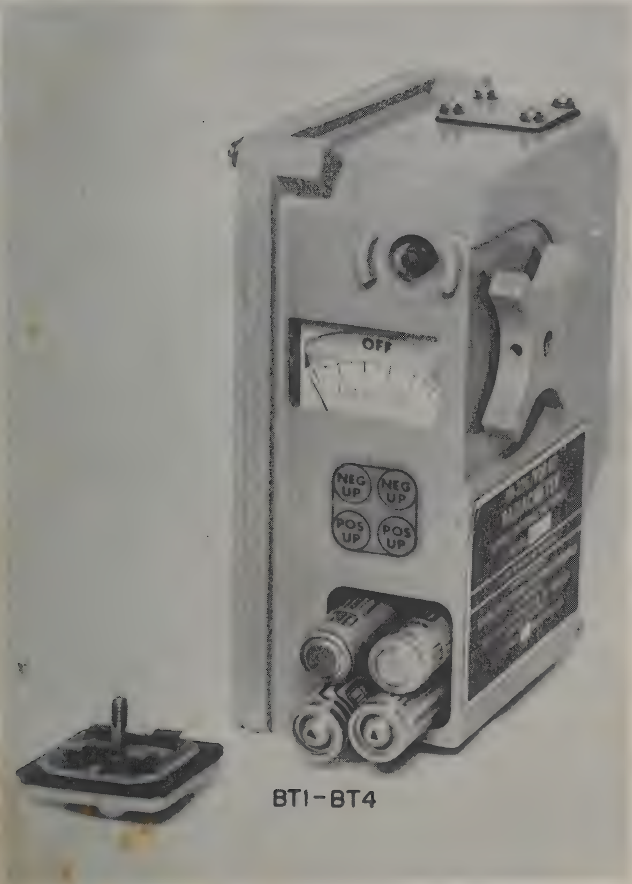

Figure 2-2. Insertion of Batteries in High Range Unit

(6) If the procedures indicated in paragraphs a. and b. indicate satisfactory performance, the equipment is ready for use. If any malfunctions are observed, refer to Section 4.

2-4. CABLE ASSEMBLIES

a. The Skin Dose or the Low Range accessory attaches to the High Range unit by means of their respective flexible cables, terminated in a 10 pin twist lock connector.

b. The Low Range probe is permanently attached to the Low Range module by means of a non-kink coil cord easily extendable 42-inches without undue tension.

c. No other cable is required for instrument operation.

2-5. INTERFERENCE REDUCTION

There are no significant radiations emanating from the AN/PDR-63 while operating on any range or with any accessory.

SECTION 3

OPERATION

3-1. FUNCTIONAL OPERATION

Radiac Set, AN/PDR-63 is a modular portable battery operated radiation detector and indicator which covers radiation measurements over nine ranges. Battery power and meter readout are integral with the High Range unit. Range coverage is as indicated in Table 3-1. Rechargeable nickel cadmium batteries (4 size AA) power the High Range and/or either accessory for a period of approximately 30-hours from a set of fully charged batteries. Exhausted cells are fully recharged over a 36-hour period in the Charger unit, PP-6597/PDR-63. Radiation detection is accomplished by a recycling ion-chamber on both the High Range and Skin Dose units and by a Geiger-Mueller (GM) tube operated in both pulsed and d.c. modes on the Low Range unit. The indicating meter is contained in the High Range unit. Scale divisions are fixed while the range information and cardinal point values rotate on a drum with the range switch. The appropriate information is visible through a window slot in the meter.

3-2. PREPARATION FOR USE

a. Radiac Set AN/PDR-63 is complete and ready for general surveying work providing the 4 nickel cadmium batteries are properly installed and the meter indication is above the low battery mark when the range switch is turned to BATT. If the meter indication is on or close to the low indication, replace

TABLE 3-1. AN/PDR-63 RANGE COVERAGE

RANGE	UNIT OR MODULE		RADIATION	
	NAME	NOMENCLATURE	MEASURED	DETECTED
BATT	High Range	IM-226/PDR-63	—	—
0-1000 rad/hr	"	"	Gamma	—
0-100 rad/hr	"	"	Gamma	—
0-10 rad/hr	"	"	Gamma	—
0-5000 rad/hr	Skin Dose	DT-508/PDR-63	Beta, Gamma	Beta
0-500 rad/hr	"	"	"	"
0-1000 mrad/hr	Low Range	DT-507/PDR-63	Gamma	Beta
0-100 mrad/hr	"	"	"	"
0-10 mrad/hr	"	"	"	"
0-1 mrad/hr	"	"	"	"

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	NAME	NOMENCLATURE	MEASURED	DETECTED
BATT	High Range	IM-226/PDR-63	—	—
0-1000 rad/hr	"	"	Gamma	—
0-100 rad/hr	"	"	Gamma	—
0-10 rad/hr	"	"	Gamma	—
0-5000 rad/hr	Skin Dose	DT-508/PDR-63	Beta, Gamma	Beta
0-500 rad/hr	"	"	"	"
0-1000 mrad/hr	Low Range	DT-507/PDR-63	Gamma	Beta
0-100 mrad/hr	"	"	"	"
0-10 mrad/hr	"	"	"	"
0-1 mrad/hr	"	"	"	"

the batteries with a known charged set. Observe indicated polarity (see Figure 2-2). Initiate a charging cycle for the dead batteries as outlined in paragraph 2-3a.

b. The High Range module, Figure 3-1, and either or both accessories may be carried by the operator by attaching the respective pouches to a web belt. All operating controls are accessible. Only one accessory at a time may be connected to the High Range unit.

c. If beta detection is desired when using the low range module, Figure 3-2, open the end window cover exposing the mica window of the GM tube. For greater beta sensitivity, rotate the side window shutter to the open position.

d. If aural indication of radiation intensities is desired while monitoring with the low range accessory, connect the headset, H-43B/U to the BNC jack on the end of the low range housing

CAUTION

Do not puncture the thin mica window of the GM tube or bring small or sharp objects in the vicinity. The thin side wall is protected by a mylar cover on the rotating sleeve, but care should be exercised not to puncture or damage this waterproof covering

e. If beta measurements are to be taken using the skin dose accessory, Figure 3-3, similar caution should be exercised not to puncture the thin window area of the probe.

3-3. OPERATING PROCEDURES

a. High Range Only - Turn the range switch to BATT. Upscale meter indication to almost full scale

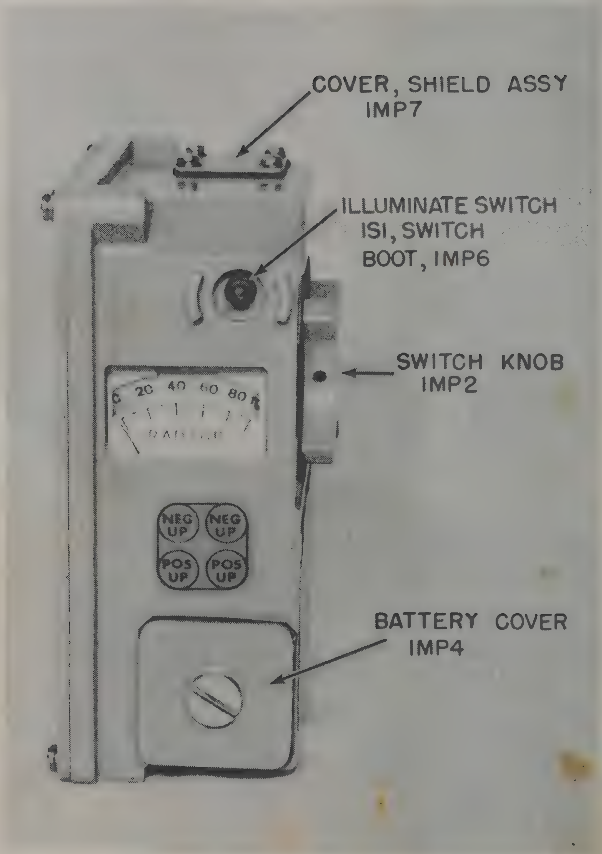


Figure 3-1. High Range Unit, IM-226/PDR-63

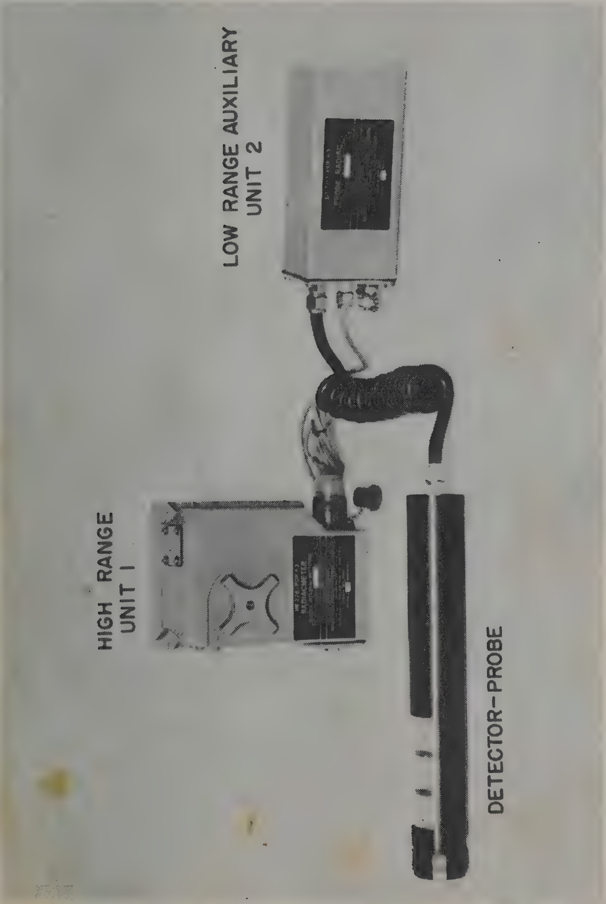


Figure 3-2. Low Range Accessory, DT-507/PDR-63

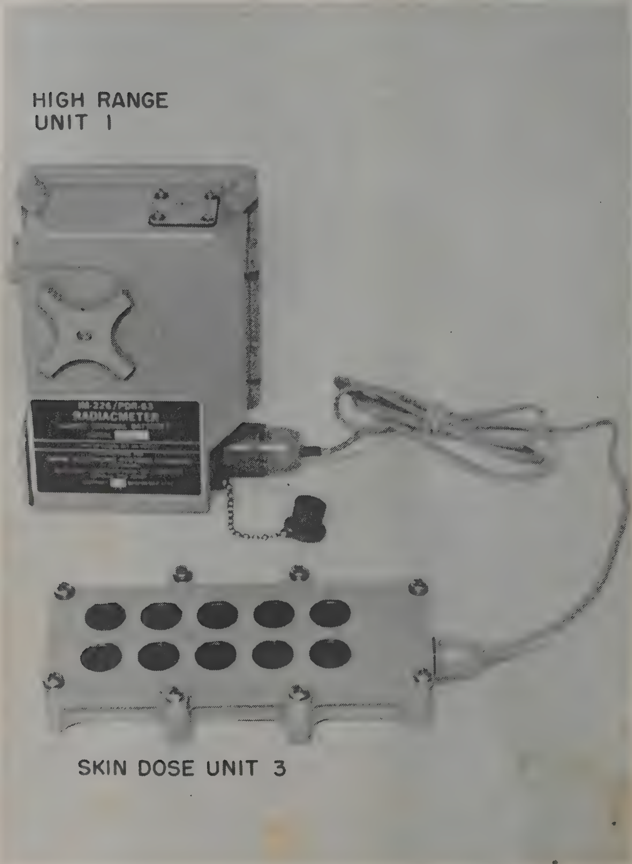


Figure 3-3. Skin Dose Accessory, DT-508/PDR-63

shows a good battery condition. Advance the range switch through 0-1000, 0-100 and 0-10 rad/hr and observe meter for radiation indication. Move set position (or rotate) for maximum reading. Select range that results in the highest readable pointer position. Depress ILLUM switch if necessary to observe meter. Gamma energies only from 80 kev to 1.3 mev are detected with the High Range unit.

WARNING

It should be emphasized here that although the equipment measures up to 1000 rad/hr, personnel exposure times on this range are exceedingly short. In a 1000 rad/hr field, a fatal radiation dose could be received in less than 14-minutes.

b. Skin Dose Measurements - Connect the skin dose probe to the high range unit (J1). Advance the range switch to the SKIN DOSE 0-5K (5000) and then to the SKIN DOSE 0-5C (500) rad/hr range. The instrument operating in this manner may now be used to measure beta-gamma radiation intensities from 50 to 5000 rad/hr. The probe, properly used, can extend the deep-dose (gamma) capability of the instrument to 5,000 rad/hr; the operator may discriminate between response from skin dose or deep dose by covering the window. Since there is no lead foil shielding the probe, the response to low photon energies will be somewhat different from that of the gamma detector.

WARNING

A similar warning is in order if gamma only measurements are indicated on the 0-5K rad/hr scale. In a 5K (5000) rad/hr field, a fatal dose could be received in less than 6-minutes.

c. Low Range Measurements - Connect the low range auxiliary to the high range unit (J1). Advance the range switch to the Millirad range 0-1K (1000), 0-1C (100), 0-10 and 0-1 mrad/hr and select the range that results in highest on-scale reading. With the probe end and side windows closed, gamma energies in the range 80 kev to 1.3 mev are measured. Any increase in reading when the beta windows are exposed indicate a presence of beta. If aural indications are desired when using the low range unit, connect the headset to the BNC jack on the low range module. There is always sufficient background radiation to cause random upscale meter indications on the 0-1 mrad/hr range as well as simultaneous clicks in the headset.

3-4. STOPPING THE EQUIPMENT

Rotate the range switch to the OFF position. Even in BATT position full load is applied and will result in run down batteries. The Charger unit, PP-6597/PDR-63 may be left on indefinitely even with batteries in place.

3-5. SUMMARY OF OPERATING PROCEDURES

a. Remove equipment from the carrying case.

b. Keep units in pouches and hook to a web belt for carrying purposes.

c. Connect desired auxiliary unit to High Range Radiacmeter. If no significant beta dose is to be measured, connect the Low Range module thus providing gamma coverage from 1000 rad/hr to 1 millirad/hr.

d. Advance range switch for appropriate highest on-scale meter reading.

Note

Meter reading will be zero if operating on a range without the appropriate accessory connected.

e. Depress ILLUM switch if necessary only long enough to determine average meter reading.

f. Connect the headset for aural indications, if desired, when monitoring using the Low Range auxiliary.

g. Rotate the side wall window of the probe to scan for beta. Similarly, open and snap back the end window cover. Be careful not to puncture window.

h. When performing beta measurements, always be sure to take a gamma background first (beta window covers closed) which must be subtracted from the combined beta-gamma reading.

i. Rotate the range switch to OFF to secure equipment.

3-6. AUXILIARY CONTROLS

There are no auxiliary controls required for operation. A calibration potentiometer is available after removal of a seal screw in the High Range and a CAL ADJ screw is available on the reverse side of the Skin Dose probe, however, these are not to be touched unless recalibration is intended. Refer to Section 5.

3-7. EMERGENCY OPERATION

a. Radiac Set AN/PDR-63 may be operated if one or two of the three detecting modes are known to be bad. That is, if the High Range recycling ion chamber is known to be bad, measurements may still be performed by either the Skin Dose or Low Range auxiliaries.

b. If measurements must be taken and a charged set of batteries are not available, substitute JAN-58 dry cells. Check the BATT indication frequently when using the set in this manner.

CAUTION

Do not attempt to recharge any batteries except the intended nickel cadmium cells.

SECTION 4

TROUBLE SHOOTING

4-1. LOGICAL TROUBLE SHOOTING

The trouble shooting procedures are based on six logical steps. The following paragraphs, a through f, outline these logical steps.

a. Symptom Recognition - This is the first step in the trouble shooting procedure and is based on a complete knowledge and understanding of equipment operating characteristics. All equipment troubles are not the direct result of component failure. Therefore, a trouble in an equipment is not always easy to recognize since all conditions of less than peak performance are not always apparent. This type of equipment trouble is usually discovered while accomplishing preventive maintenance procedures. It is important that the "not so apparent" troubles, as well as the apparent troubles, be recognized.

b. Symptom Elaboration - After an equipment trouble has been "recognized", all the available aids designed into the equipment should be used to further elaborate on the original trouble symptom. Use of front panel controls and other built-in indicating or testing aids should provide better identification of the original trouble symptom. Also, checking or otherwise manipulating the operating controls may eliminate the trouble.

c. Listing Probable Faulty Function - The next step in logical trouble shooting is to formulate a number of "logical choices" as to the cause and likely location (functional section) of the trouble. The "logical choices" are mental decisions which are

based on knowledge of the equipment operation, a full identification of the trouble symptom, and information contained in this manual. The overall functional description and its associated block diagram should be referred to when selecting possible faulty functional sections.

d. Localizing The Faulty Function - For the greatest efficiency in localizing trouble, the functional sections which have been selected by the "logical choice" method should be tested in an order that will require the least time. This requires a mental selection to determine which section to test first. The selection should be based on the validity of the "logical choice" and the difficulties in making the necessary tests. If the tests do not prove that functional section to be a fault, the next selection should be tested, and so on, until the faulty functional section is located. As aids in this process, the manual contains a functional description and servicing block diagram for each functional section. Waveforms (or other pertinent indications) are included at significant check points on servicing block diagrams to aid in isolating the faulty section. Also, test data (such as information on control settings, critical adjustments, and required test equipment) are supplied to augment the functional description and servicing block diagram for each functional section.

e. Localizing Trouble To The Circuit - After the faulty functional section has been isolated, it is often necessary to make additional "logical choices" as to which group of circuits or circuit (within the functional section) is at fault. The servicing block diagram provides the signal flow and test location information needed to bracket and then isolate the faulty circuit. Functional descriptions, simplified schematics, and pertinent test data for individual circuits or groups of circuits comprising the functional section are all placed together in one area of

the manual. Insofar as is practicable, this information is contained on facing pages. Information which is too lengthy in nature to be included in this arrangement is readily referenced from the test data portion of the trouble shooting information.

f. Failure Analysis - After the trouble (faulty component, misalignment, etc.) has been located (but prior to performing correction action), the procedures followed up to this point should be reviewed to determine exactly why the fault affected the equipment in the manner it did. This review is usually necessary to make certain that the fault discovered is actually the cause of the malfunction, and not just the result of the malfunction.

4-2. OVERALL FUNCTIONAL DESCRIPTION

With reference to Figure 4-1, the High Range unit contains the primary power, the meter readout and the range switch which selects the appropriate mode of detection for the accessory connected to J1. The Charger functions independently and is intended to recharge 4 nickel cadmium size AA cells only.

4-3. FUNCTIONAL CIRCUIT DESCRIPTION

a. High Range Radiacmeter, IM-226/PDR-63 - The high range radiacmeter as shown in Figure 4-1 comprises a pressurized recycling ion chamber, the output of which is a pulse rate proportional to the incident radiation doserate. A simple integrating circuit converts the pulse rate to a d.c. which drives a microammeter calibrated in rad/hr. A simplified schematic diagram of the recycling circuit is shown in Figure 4-2. The four basic components are the:

(1) The deep-dose (gamma) detector, a 32.6cc aluminum ionization chamber filled with argon to 12 atmospheres pressure and enclosing a JAN 5886

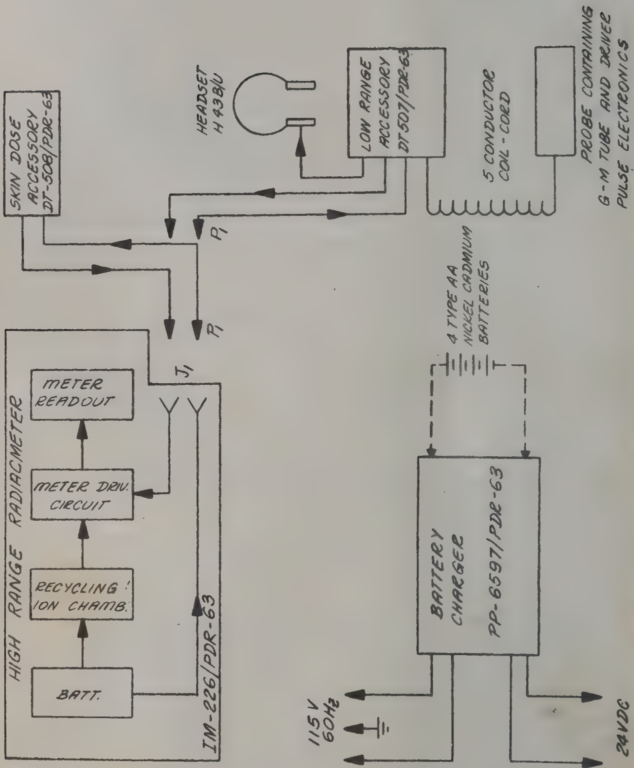


Figure 4-1. Overall Functional Block Diagram

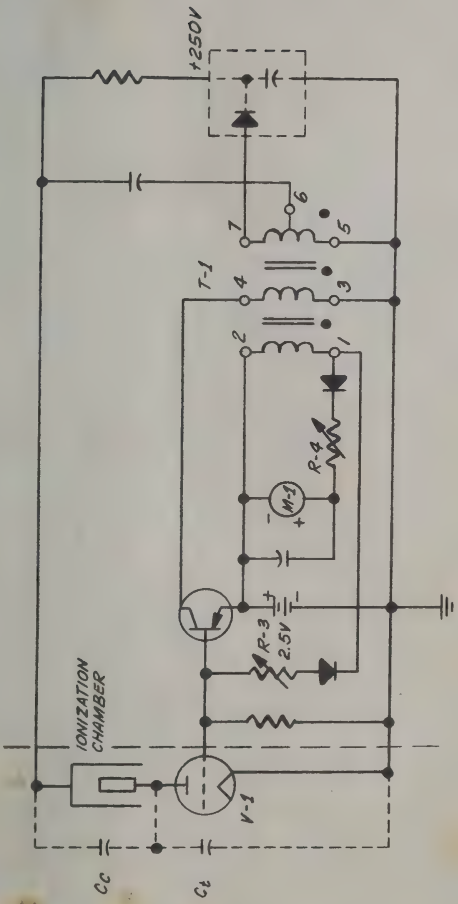


Figure 4-2. Simplified Schematic Diagram
High Range Radiacmeter

electrometer tube (see Figure 4-3. Electrically important high-resistance insulators are sealed within the detector — the inner collector and the plate of the tube are connected directly, without an external lead. Resistance between this inner collector and the shell (at 250 V) is established by the chamber ionization current of 5.5×10^{-11} amp per r/hr; for 1 percent error, leakage would be 5×10^{-13} amp. Resistance approaching 10^{15} ohms would be needed except for the "guard ring" effect achieved by using the "feed-thru" pins, at ground potential, to support the collector insulator; this design requires an insulation of less than 10^{14} ohms between the collector and pins. Externally, between the pins and the shell, 5×10^{10} ohms is sufficient.

Two electrical capacitances within the chamber are important: (1) that between the shell and inner collector (C_c) and (2) that between the inner collector and the base "feed-thru" pins, measured with the tube in place (C_t). C_c should be 6.4 ± 0.3 uuf and $C_t = 8.3 \pm 0.5$ uuf.

Measurements show that collection of the ionization current at 1,000 rad/hr with 98 percent efficiency requires approximately 160 V between the shell and the collector. The circuit provides more than 250 V, normally, to allow for slight variations in the purity of the argon (oil-free, 99.07 percent pure) and to allow for auxiliary recycling detectors such as the Skin Dose probe.

Lead shielding surrounds the detector to reduce the dependence of ionization on photon energy.

(2) The recycling circuit integral with the High Range unit, Figure 4-2 which is composed of two regenerative feedback loops (a) trigger loop consisting of the inverted electrometer V-1, transistor Q-1, windings 3-4 and 5-6 of transformer T-1, and the

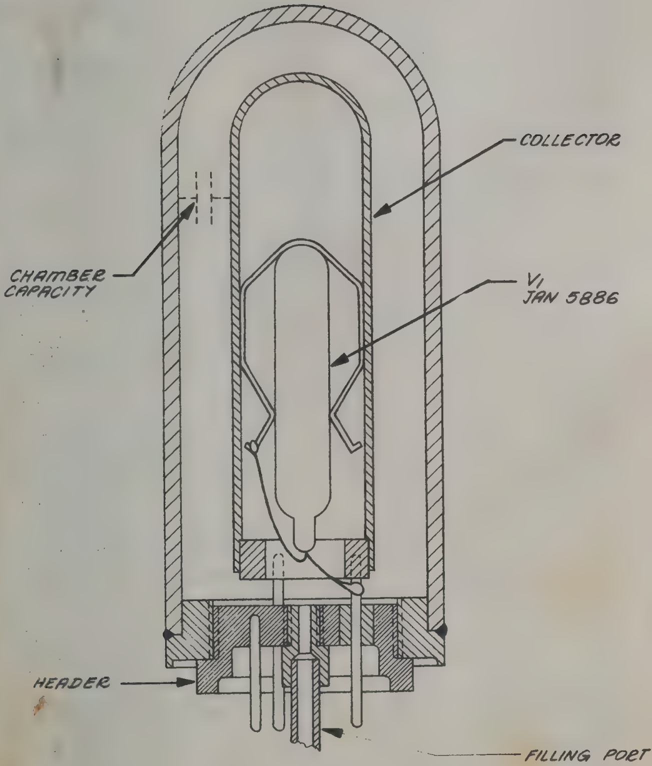


Figure 4-3. High Range Ion Chamber Assembly

detector capacitance C_c and, (b) a low impedance drive loop consisting of Q-1 and windings 3-4 and 1-2 of T-1. Transformer winding 5-7 and the associated rectifier circuit is used as a direct current supply for the chamber polarizing voltage.

Referring to Figure 4-2, assume that a recycling event has just occurred and the charge on C_c is such that the potential of the plate (control electrode) of V-1 is sufficiently negative to cut-off the current flow to the positive grid. Incident radiation will cause ionization in the detector and a resultant loss of charge on C_c. The plate potential of V-1 becomes less negative and the grid current begins to flow, whereupon the system begins to oscillate around the regenerative trigger loop. At some particular value of grid current, the oscillation will be large enough to initiate the blocking cycle and activate the low-impedance drive loop. The transformer core is driven to saturation, the circuit blocks, and the energy stored in the inductance of the transformer is delivered to the meter. During the on time of Q-1, the positive voltage pulse that appears on winding 5-6 recharges the detector capacitance C_c through the diode action of the electrometer plate. When the pulse disappears, the plate is again biased negative, the ionization chamber discharges, and the cycle is repeated.

Since the rate at which the ionization chamber discharges is directly proportional to the intensity of the radiation, the recycling rate of the circuit is a direct measure of the radiation dose rate. The nominal recycling rates for full scale meter indications on the 0-10, 100, and 1,000 rad/hr ranges are 5, 50, 500 cps. Range changing is accomplished by switching meter shunt resistors, and the instrument is calibrated by adjusting R-4. The

variable resistor R-3 is set to limit the peak collector current of Q-1 to a nominal value of 130 ma.

A complete schematic diagram of the basic High Range module is shown in Figure 5-11.

(3) The range switch (S1, Figure 5-1) which is the only control necessary for instrument operation, is a two wafer, four pole rotary surrounded by the meter range indicating drum. Switching functions are divided as follows:

(a) S1A controls the filament of either V1 of the High Range recycling ion chamber or V1 of the Skin Dose recycling ion chamber if connected. S1A also provides the switching control necessary for the Low Range high voltage generation.

(b) S1B distributes 2.5 volt battery power.

(c) S1C selects the appropriate meter shunt for range changing.

(d) S1D directs the input signal from the unit or accessory in use to the base of Q1 to initiate a meter driving pulse.

(4) The metering circuit, Figure 5-11, is comprised of M1, R6 in parallel with RT1, R7 in parallel with RT2 and C2 and C3 which provides the necessary integrating time constants (for averaging the random fluctuations) and also compensates for the change in driving signal due to the change in the characteristics of Q1 with temperature.

b. <u>Skin Dose Accessory, DT-508/PDR-63</u> The Skin Dose probe is simply an externally connected recycling ionization chamber designed into a 40-cc ionization chamber intended to measure the radiation dose absorbed by the sensitive layer of the skin. To accomplish this, special materials and dimensions are used which simulate human epidermal absorption characteristics. The ionizing gas is air which, at atmospheric pressure and 1 cm depth, absorbs beta and gamma radiations to about the same degree as a

germinal layer of skin cells. The protective outer skin (stratum corneum) is simulated by the 10 mg/cm^2 window; material for this window, a 40-cm^2 mylar-aluminum-polyethylene sandwich, is chosen also because of its toughness and low vapor permeability.

Schematically, the probe is shown in simplified form in Figure 4-4. The internal chamber capacity C_c is shunted by an adjustable calibrating capacitor C1. When connected to J1 in the High Range unit and the range switch turned to either 0-5K or 0-5C rad/hr the theory of operation is the same as that described in paragraph 4-3, a, (2).

The recycling rate for full scale meter indications on the 0-5K and 0-5C rad/hr ranges are that of the 0-100 and 0-10 rad/hr ranges. Compatibility with the High Range full scale counts per second is provided by the calibration capacitor C1.

c. Low Range Accessory, DT-507/PDR-63 - The Low Range auxiliary enables extension of the radiation measurements over four additional ranges of 0-1000, 0-100, 0-10 and 0-1 mrad/hr when connected to the High Range unit. To enable coverage over these four ranges by a JAN 8204M GM tube, sufficiently sensitive to the lowest range, a combination of conventional d.c. and pulsed operation is necessary.

On the 0-100 and 0-1000 mrad/hr ranges, the GM tube is operated in the pulsed mode. The d.c. anode voltage of the GM tube is maintained at 555 V, which is well below the Geiger threshold, and the tube is periodically pulsed into the Geiger region by a "driver" pulse from the pulse generator. This pulse is about 150 V in amplitude, 5-7 microsecond effective width and occurs at a rate of about 1.2 to 1.4 kc. The GM tube is active only during the effective period of the "driver" pulse; therefore, only those radiations interacting in coincidence with this pulse will result in an output Geiger pulse.

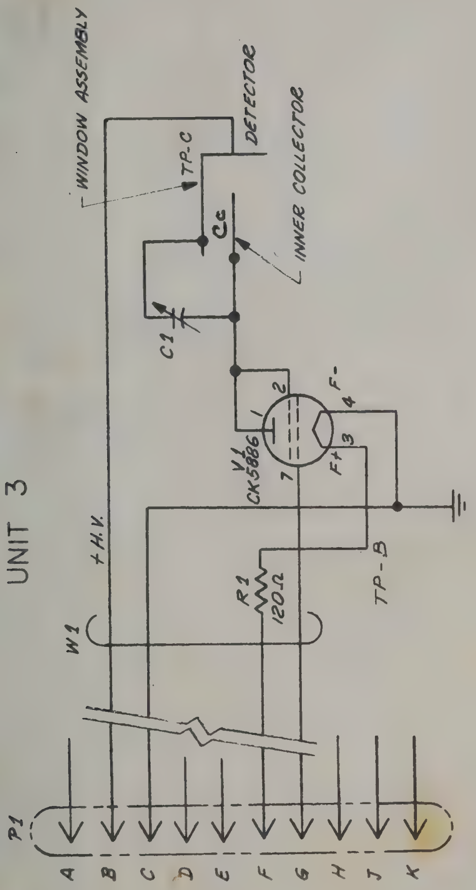


Figure 4-4. Schematic Diagram of Skin Dose Probe

On the 0-1 and 0-10 mrad/hr ranges, the GM tube is operated in the normal manner with a d.c. anode potential of 700 V. The "driver" pulses, however, are still applied to the tube but at a reduced amplitude. This is done to overcome the effects of GM tube saturation in high radiation fields. In high fields, the GM tube output becomes a continuous current and the output pulse rate falls to zero. Normally, this would result in a zero meter indication on the radiacmeter. However, when the "driver" pulses are applied, the lower impedance of the continuously conducting GM tube results in these "driver" pulses passing as GM tube signals and triggering the high range metering circuit at its maximum allowable rate (greater than 500 cps) which results in an off scale reading.

Much literature exists describing the theory of GM tube operation both in the conventional and pulsed mode of operation. It is not considered nesessary for the purposes of this manual to reiterate all the theory. In summary, conventional d.c. operation of sensitive GM tubes in high field intensities normally results in a severe departure from linearity because of the inherent tube dead time. Pulsed operation of the tube overcomes this problem and in fact extends the useful range of any counter tube. Under pulsed operation, the tube is pulsed into the Geiger region by shaped pulses of definite width and fixed amplitude superimposed on a d.c. bias below the threshold of counting. Thus, for the pulse duration only, the GM detector is sensitive to radiation and during this "on-time" a certain probability exists that an ionizing event will occur in the detector. The degree of probability depends upon the strength of the radiation field and the width of the superimposed voltage pulse. Only one ionizing event can occur during any one applied "driver" pulse since the pulse "on time" is less than the inherent dead time of the GM tube.

The Low Range auxiliary circuitry contained on two boards, 2A1A1, and 2A2A1, can be divided functionally into three parts consisting of (1) a power supply which furnishes two stable voltage outputs; one is used to set the GM tube bias level just below the threshold of counting and the other provides the regulated d.c. for the driver pulse generator. (2) a driver pulse generator with suitable pulse characteristics which periodically pulse the GM tube into the Geiger region. (3) an output circuit which can match the GM tube output pulse to that required by the High Range meter triggering circuit while discriminating against the capacitively coupled signal of the repetitive driver pulses. With reference to the overall Low Range schematic, Figure 5-12, each of these functions will be discussed.

(1) Power supply voltages are generated by the blocking oscillator circuit of 2A2A1Q1 and 2A2A1T1 wherein the transistor is alternately switched on and off by the regenerative feedback provided by the transformer secondary to the base of Q1. This action results in an asymmetrical, rectangular voltage waveform on the transformer windings (see Figure 4-7). The low voltage for the probe circuitry is obtained by a voltage tripler operating from the primary of T1. On the 0-1 and 0-10 mrad/hr ranges, the low voltage is stabilized at a nominal -26 Vdc by a feedback regulating circuit, the main elements of which are transistors 2A2A1Q2 and 2A2A1Q3 and Zener reference diode 2A2A1CR8. In this circuit, the Zener reference voltage is compared to a portion of the output voltage taken from the bleeder string comprised of 2A2A1R3, R11, RT1 and R4. The differential voltage is used to regulate the input power to the oscillator so that the output voltage remains constant regardless of variations in battery voltage and output load requirements. On the 0-100 and 0-1000 mrad/hr ranges, the low voltage is increased

to -38 V (nominal) by shorting R4 in the output bleeder string. This is accomplished with the range switch in the high-range module (S1A) and provides the necessary driver pulse amplitude for pulsed operation.

The 700 V for the d.c. operation of the GM tube is obtained by a voltage tripler circuit operating from the high voltage tertiary winding of T1. The 550 V bias required for the pulsed GM operation (0-100 and 0-1000 mrad/hr ranges) is obtained by removing one section (2A2A1C8 and 2A2A1CR4) from the tripler circuit, thereby converting it to a voltage doubler. This is also accomplished with the range switch in the high range module, S1A.

Potentiometer 2A2A1R3 sets the 550 V bias and 2A2A1R4 sets the 700 V GM tube center of plateau operating voltage. Potentiometers 2A2A1R5 and 2A2A1R12 control the driver pulse repetition rate and pulse width respectively. Instructions for adjustments of all controls are given in Section 5.

(2) Driver pulses are generated by another blocking oscillator comprised of 2A1A1Q1 and 2A1A1T1 (part of the probe assembly). With reference to the simplified drawing, Figure 4-5, Q1 initially conducts base current through a low impedance path of R12, C1, winding 1-2 of T1 and CR1 and winding 3-2 of T1 tending to charge C1. This base drive causes collector current through winding 3-2 (peak limited by R6) inducing a voltage in winding 2-1 that back biases CR1 and causes C1 to charge more rapidly. The circuit regenerates in this manner until C1 is fully charged at which time Q1 is back biased and collector current ceases. At this time the flyback voltage of T1 is clamped by CR1 and the circuit remains non-conducting until C1 discharges through a high resistance path, R5 and winding 2-1 to where Q1 is again forward biased. During the

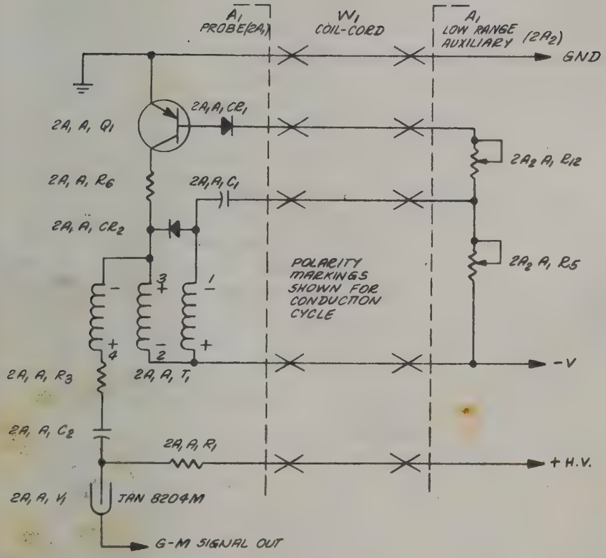


Figure 4-5. Driver Pulse Blocking Oscillator

conduction cycle, a 180 V pulse is developed in winding 4-2 which is superimposed on the d.c. bias voltage and applied to the GM tube through 2A1A1R3 and 2A1A1C2.

Potentiometer 2A2A1R12 determines the developed pulse width (conduction time of Q1) and potentiometer 2A2A1R5 determines the pulse repetition rate (discharge time of C1). Instructions for adjustments of these controls are given in Section 5. On the 0-1000 and 0-100 mrad/hr ranges, the driver pulse at the GM anode is approximately 150 volts amplitude and 5 to 7 microseconds wide. Pulse repetition rate is approximately 1200 to 1400 pps.

On the 0-100 and 0-10 mrad/hr ranges, the amplitude only is reduced to about 100 V. Pulse width and repetition rate are unchanged. Operational data for each low range is shown in Table 4-1.

When the driver pulse is applied during the "dc" operation of the GM tube, the anode voltage instantaneously rises to about 800 V. If a Geiger event occurs during this time, the peak current through the tube can rise to relatively high values. Because of this, current-limiting resistor 2A1A1R7 was added to the anode circuit. The resistance was made as large as possible without degrading the "driver" pulse wave shape at the anode.

(3) GM Pulse Output Circuit - The output circuit, consisting principally of two transistors, 2A1A1Q2 and Q3, inverts the positive output pulse from the Geiger tube cathode, delivering a negative pulse at a suitably low impedance to drive the high range circuit which serves as a ratemeter. In addition, the residual driver pulses which appear in the Geiger tube output as a result of its anode-cathode capacitance, are wiped out by anticoincidence action of the circuit. This is accomplished by driving transistor Q3 with driver pulses through a capacitor of similar value to the Geiger tube capacitance. This

TABLE 4-1. OPERATIONAL DATA FOR MRAD/HR RANGES

RANGE MRAD/HR	HIGH VOLTAGE	PULSE VOLTAGE	AVG. C.P.S. IN FULL SCALE FIELD
0-1000	560	150	
0-100	560	150	
0-10	700	100	590
0-1	700	100	65

transistor then acts as a low impedance shunt for any signal simultaneously appearing at the base of transistor Q2. The result is that no signal passes through the output circuit during the time that a driver pulse exists. The Geiger pulses, many times longer in duration, are not shunted except for the initial rise time of the driver and are passed through the circuit to the ratemeter.

An emitter follower 2A2A1Q4 couples the GM output signals to the low impedance headset, H-43B/U which, when used, connects to 2A2J1.

Thermistor 2A2A1RT2 was added to prevent spurious counting at high temperatures. Noise in the low-range accessory output signal line triggers the recycling circuit in the high-range module at high temperatures. RT2, which in effect shunts the input of the recycling circuit, decreases in resistance with increasing temperature, thereby reducing the trigger sensitivity of the recycling circuit. The addition of RT2, however, causes a high d.c. bias current in the recycling circuit when the low-range accessory is attached and the function switch is in the skin dose positions. This bias current causes the recycling circuit to oscillate and drives the meter off scale. Connecting pins F and G in the low-range accesory connector 2A2P1 eliminates any oscillation.

d. Battery Charger - The battery charger, Figure 4-6, can be used on 115 V AC or 24 V DC. The four batteries are charged in a series parallel configuration. When operated from a 115 V AC source, transformer T1, diodes 4CR1, 4CR2 and current limiting resistor 4R2 provide the necessary full wave rectified DC voltage for charging the batteries. When the charger is operated with an input voltage of 24 V DC, diode 4CR3 and current limiting resistor 4R1 provide the charging circuit for the batteries. The diodes also prevent the batteries from discharging into the charging source when they are fully charged.

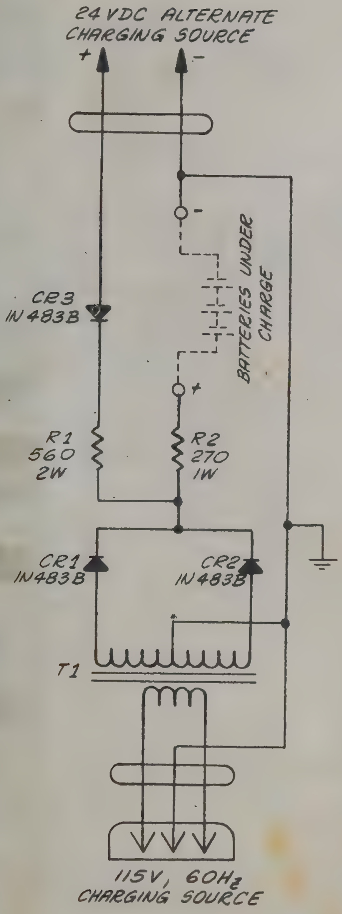


Figure 4-6. Battery Charger Schematic

4-4. FUNCTIONAL SECTION BLOCK DIAGRAM

Because of the relative simplicity of this instrument, the Functional Section Block Diagram is identical to the Overall Functional Block Diagram, Figure 4-1.

4-5. SERVICING BLOCK DIAGRAM

Trouble Shooting and servicing the Radiac Set, AN/PDR-63 is simplified by using the Servicing Block Diagram, Figure 4-7. The test points indicated on the diagram should be examined for conformity to the idealized waveform shown. Any significant departure from the voltages and waveforms shown at the test point indicates a malfunction of one or more components, in the vicinity of the test point. Initially, all test points should be checked and any departure noted such that an overall picture of the equipment performance can be obtained. When a departure from the expected voltage or waveform is observed, disconnect all connections to the next section. The section immediately preceding the test point should then be examined for faulty components. When the trouble in that section has been remedied, the connections to successive sections should be re-established and the above procedure repeated for the next test point. This procedure should be continued until all test point checks indicate the prescribed voltages and waveforms. The equipment should then be ready for normal operation.

4-6. RADIAC SET, AN/PDR-63 OVERALL TROUBLE SHOOTING CHART

Step-by-step procedures given in Table 4-2 illustrate a systematic method for recognizing, isolating and correcting equipment malfunctions. The Table is intended as a guide and does not necessarily include all possible sources of trouble.

TABLE 4-2. RADIAC SET, AN/PDR-63 OVERALL TROUBLESHOOTING CHART

STEP	PRELIMINARY ACTION	NORMAL INDICATION	PROCEDURE
1	Turn Range Switch to BATT.	Meter should read above the BATT line. Normal battery at TP1 is 2.5 V.	If indication is on or below line, replace the batteries. Refer to Section 2.
		Electrostatic or VTVM reading at TP 3 is at least 250 V.	Check for free running mode of blocking oscillator Q1. Approximate rep. rate of 3k.c.
2	Turn Range Switch to 1000.	In the absence of radiation, the meter should read zero.	Check for periodic recycling pulse at TP2 (about every 18-seconds).
3	Turn Range Switch to 100.	Same as Step 2.	Same as Step 2.
4	Turn Range Switch to 10.	Same as Step 2.	Same as Step 2.

TABLE 4-2 (Continued)

STEP	PRELIMINARY ACTION	NORMAL INDICATION	PROCEDURE
5	Connect Skin Dose Probe to J1 and turn Range Switch to 5K (5000).	In the absence of radiation, the meter should read zero.	Check for periodic recycling pulse at TP2 (About every second). If none observed, check for 1.2 V at TP-B and at least 250 V at TP-C.
6	Turn Range Switch to 5C (500).	Same as Step 5.	Same as Step 5.
6a		If off-scale indication is observed and no radiation is present	Check for short or resistive leakage between capacitor plates. Clean all insulators as outlined in Section 5. Be careful of window.
7	Connect Low Range Auxiliary to J1 and turn Range Switch to 1000 or 100 Millirad.	In the absence of radiation, the meter should read zero.	Electrostatic or VTVM voltage at TP-4 should be +550 V +10 -5

TABLE 4-2 (Continued)

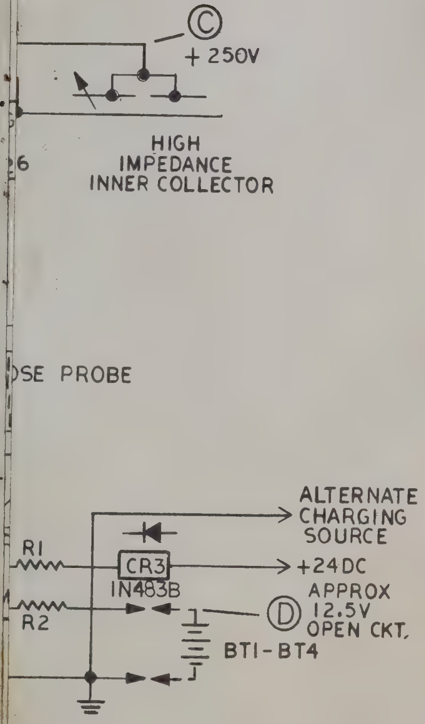
STEP	PRELIMINARY ACTION	NORMAL INDICATION	PROCEDURE
		If voltage at TP-4 is low	Adjust R3. Refer to Section 5.
		If voltage at TP-4 is very low	Check for -38 V at TP-G.
		If TP-G is O.K. then	Check winding 6-8 of T1, CR5, 6, and 7.
		If both TP-4 and TP-G indications are very low	Check waveform at TP-E and the battery voltage at the emitter of Q1.
		If poor or no regulation of output HV is observed	Check for 11.7 V across CR8 or control transistors Q2 and Q3.
8	Turn Range Switch to 10 or 1 millirad	In the absence of radiation fields, the normal background indication can be observed on the 0-1 scale.	Electrostatic or VTVM voltage at TP-4 should be +700 V $^{+10}_{-5}$

TABLE 4-2 (Continued)

STEP	PRELIMINARY ACTION	NORMAL INDICATION	PROCEDURE
		If voltage at TP-4 is low	Adjust R4. Refer to Section 5.
		If voltage at TP-4 is very low	Check for -26 V at TP-G.
		If TP-G is O.K. then	Check winding 6-8 of T1, CR4, 5, 6, and 7.
		If both TP-4 and TP-G indications are very low	Check waveform at TP-E.
9	Any Low Range	If all test points above are O.K.	Check for correct "driver" pulse waveform at TP-6. Note that V1 must be removed for this measurement (refer to Section 5).
10	0-10, 0-1 mrad Ranges	If "driver" pulses are O.K. but no GM tube signals are observed	With GM tube, V1, replaced, check for negative GM pulses at TP-5.

TABLE 4-2 (Continued)

STEP	PRELIMINARY ACTION	NORMAL INDICATION	PROCEDURE
11	Any Low Range	If meter is reading off-scale and no radiation is present	Check "inhibit circuit" Q2 and Q3 Note: Probe must be disassembled for this inspection. Refer to Section 5.
12	Battery Charger	If batteries cannot be recharged.	Check for 12.5V open circuit at TP-D when either charging source is used. Unit is potted and not normally repairable.



Servicing Block Diagram,
in Dose and Battery Charger
Sheet 1 of 3)

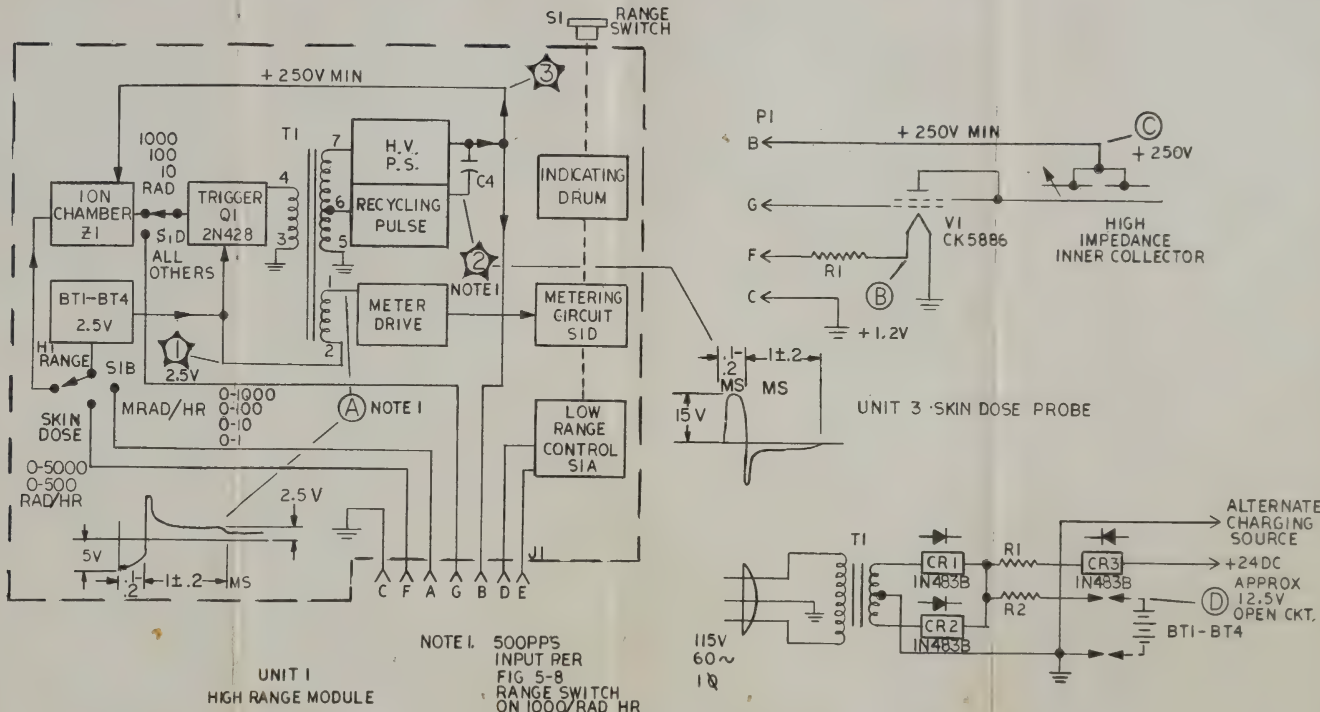
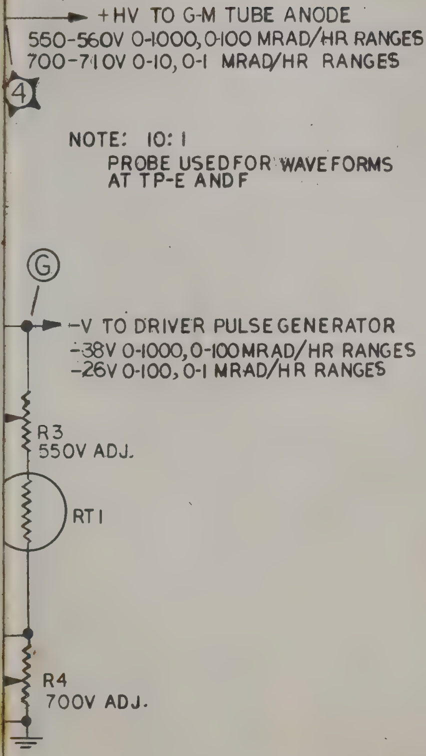


Figure 4-7. Servicing Block Diagram, High Range, Skin Dose and Battery Charger (Sheet 1 of 3)

Figure
4-7(2)



Servicing Block Diagram,
e Auxiliary Power Supply
(Sheet 2 of 3)

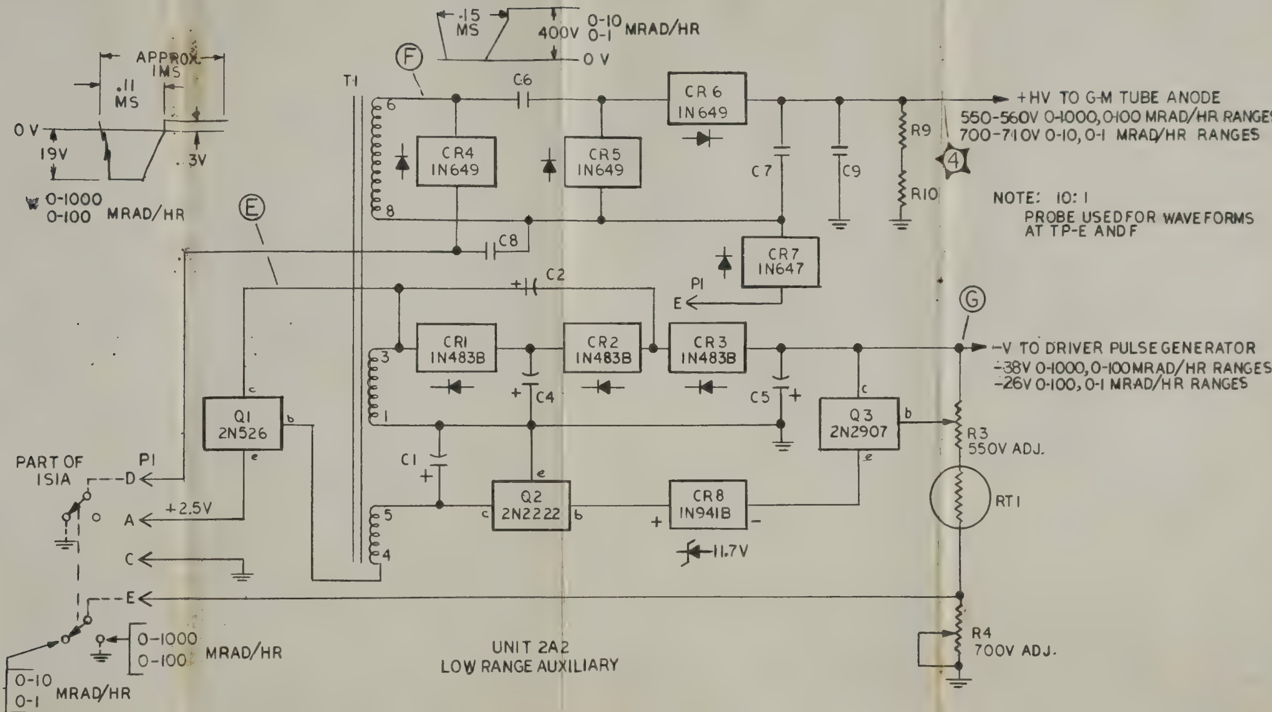
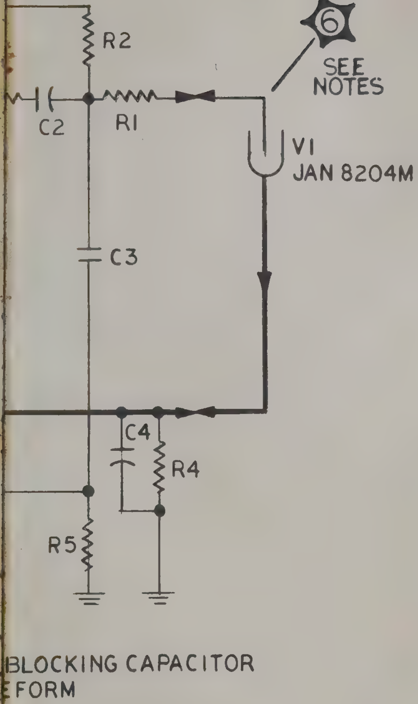
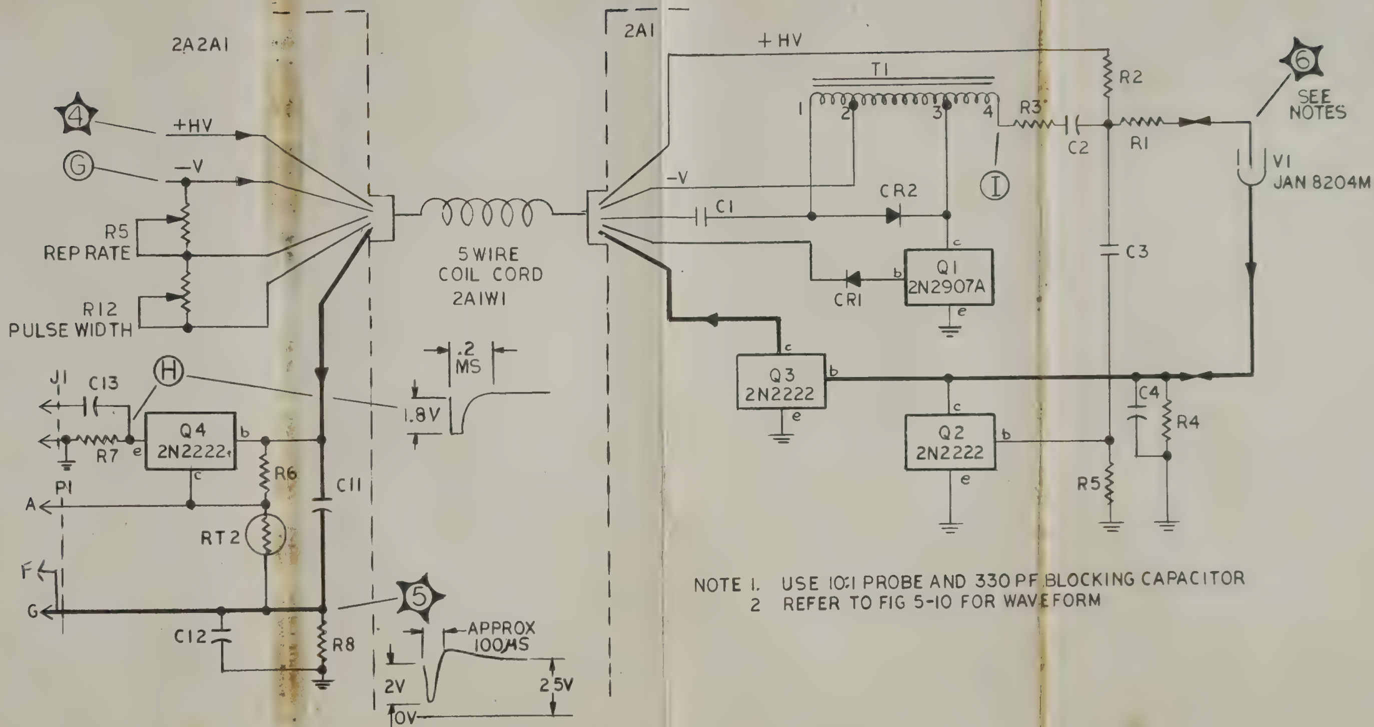


Figure 4-7. Servicing Block Diagram, Low Range Auxiliary Power Supply (Sheet 2 of 3)



Servicing Block Diagram,
ciliary, Driver Pulse Generator
Signal Circuit (Sheet 3 of 3)



NOTE 1. USE 10:1 PROBE AND 330 PF BLOCKING CAPACITOR
2 REFER TO FIG 5-10 FOR WAVEFORM

Figure 4-7. Servicing Block Diagram,
Low Range Auxiliary, Driver Pulse Generator
and Output Signal Circuit (Sheet 3 of 3)

SECTION 5

MAINTENANCE

-1. FAILURE, PERFORMANCE AND OPERA- IONAL REPORTS

The Naval Electronic Systems Command no longer equires the submission of failure reports for all quipments. Failure Reports and Performance and perational Reports are to be accomplished for esignated equipments (refer to Electronic Installation nd Maintenance Book, NAVSHIPS 900,000) only to e extent required by existing directives. All fail- res shall be reported for those equipments requiring e use of Failure Reports.

-2. PREVENTIVE MAINTENANCE

a. Test Equipment - The following list of equip- ent in Table 5-1 is adequate for troubleshooting adiac Set AN/PDR-63.

b. Special Tools - There are no special tools re- ired other than those furnished in an electronic pair kit except for "O" ring pliers, Waldes Kohi- oor Inc., Model 1120 or equivalent.

c. Special Procedures -

WARNING

High voltages (up to 750 volts) are present in this equipment which may cause injury if con- tacted by operating or maintenance personnel. The following safety precautions must be ob- served when trouble shooting the equipment.

SECTION 5

MAINTENANCE

5-1. FAILURE, PERFORMANCE AND OPERATIONAL REPORTS

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5-2. PREVENTIVE MAINTENANCE

a. Test Equipment - The following list of equipment in Table 5-1 is adequate for troubleshooting Radiac Set AN/PDR-63.

b. Special Tools - There are no special tools required other than those furnished in an electronic repair kit except for "O" ring pliers, Waldes Kohinoor Inc., Model 1120 or equivalent.

c. Special Procedures -

WARNING

High voltages (up to 750 volts) are present in this equipment which may cause injury if contacted by operating or maintenance personnel. The following safety precautions must be observed when trouble shooting the equipment.

TABLE 5-1. EQUIPMENT REQUIRED FOR MAINTENANCE

NOMENCLATURE	DESIGNATION	CHARACTERISTICS
Oscilloscope	AN/USM-24	5 mc band width, 50 V/cm vert 10 meg input imp, 1 msec/cm horiz
Multimeter (VTVM)	ME-25/U	0-1000 V DC 0-300 V DC 0-10 V DC 0.2 ohm to 500 meg
Electrostatic VM		0-1000 V
Pulse Generator	General Radio Model 1217A	10 to 1000 pps
	Franklin Model 370	0-10 V output
	Rutherford Model 903	10 to 100 microsecond width
	Berkeley Model PB-2	
Calibrated Source of Radiation	Cobalt-60 or Cesium-137 (AN/UDM-1A	125 curies for (high range calibration) 1K, 100, 10 rad/hr.

(1) Never disconnect or unsolder wires or components while Selector switch is on.

(2) Always turn Selector switch off when connecting test instruments to the equipment.

(3) Use one hand only when necessary to remove oscilloscope or multimeter probe when the Selector switch is on.

(4) Do not use test instruments known to be in poor condition.

d. Transistor Servicing Precautions -

CAUTION

The transistors in this equipment may be damaged or destroyed by careless use of test instruments or tools. To avoid damaging transistors or diodes, observe the following precautions.

(1) Only use the electronic multimeter specified in Table 5-1.

(2) When checking components for proper resistance, shorts or leakage, unsolder one terminal of the component before connecting the multimeter to it.

(3) Make certain that power is turned off before using soldering iron. Always clamp transistor leads with pliers between transistor and connection to be soldered to keep heat away from transistors. Make solder connection as quickly as possible.

(4) Make certain that clip leads, test instrument leads or metal tools are not shorting components before turning on.

e. Preventive Maintenance Procedures - Table 5-2 shows the frequency of inspection and the recommended method to be followed for routine maintenance.

TABLE 5-2. ROUTINE MAINTENANCE

WHEN	WHAT	HOW
Every Month	Inspect battery compartment in both the High Range and Charger Units for evidence of battery leakage or corrosion.	Scrape clean and sandpaper contacts if necessary.
Every Month	Recharge all batteries.	In Charger PP6597/PDR-63
Every Month	Examine scale alignment of drum and also detenting of switch over all ranges.	Visually.
Every Month	Examine Skin Dose Probe window for damage.	Visually.
Every Month	Examine Low Range Probe for damaged end or side windows.	Visually, wrinkled end window indicates loss of GM tube partial pressure.

TABLE 5-2. (Continued)

WHEN	WHAT	HOW
Every 3 - Months	Examine the coil cord and all connecting cables for evidence of a cracked jacket, bare conductors or broken insulation.	Visually
Every 6 - Months	Recalibrate all units and verify equipment operability.	As outlined in Section 5.

5-3. REPAIR

a. High Range Module Removal, Repair and Replacement of Parts - Unscrew the 4 captive 6-32 screws from the sideplate and remove plate. Remove batteries.

(1) Circuit Board Removal - Remove the four 4-40 screws (A in Figure 5-2) and carefully fold the board over to the side.

(2) Meter Removal - Remove the three 4-40 long screws (B in Figure 5-3) and withdraw the meter. Back off the 2-56 nuts and remove the meter connections. (Double white wires are plus). Remove the 3 bumper washers.

(3) Ion Chamber Removal - Remove the two 6-32 screws holding the chamber clamps. Remove chamber and slide off clamps. Handle carefully as chamber is pressurized. Remove the four terminations from chamber bottom. Identify or refer to wiring diagram for reassembly.

(4) Meter Drum Removal - Peel off RTV seal, remove "C" ring using special pliers, remove drum. Leave lower "C" ring intact.

(5) Range Switch Removal - Loosen two 6-32 set screws from and remove switch knob, remove 3/8-inch nut and lockwasher from switch bushing. Remove switch, taking care not to strain the lugs.

(6) Reassembly - Reassemble all parts in reverse order making sure all wire connections are proper and secure, meter bumper washers in place and meter drum resealed (using RTV or similar compound) to eliminate backlash and scale misalignment. Effect alignment in any radiation range position. Since this operation is not anticipated as a routine repair, it did not appear necessary to set screw the drum in position.

b. Skin Dose Probe Removal, Repair and Replacement -

(1) Unscrew eight 6-32 pan-head screws and

carefully fold top plate over taking care not to break connection from the calibrating capacitor plate. Test Points B and C are now accessible.

(2) Unsolder the connection from the tube to the collector plate. Unscrew two 4-40 screws (C in Figure 5-4). Carefully remove plate and four polystyrene washers.

(3) Window assembly should be inspected for breaks. The window "sandwich" and its continuous epoxy seal around the entire perimeter of the grid is too complicated for a simple repair. Replacement of the entire grid and window should be made.

(4) Reassemble in reverse order. Be sure to clean the four polystyrene insulating washers in alcohol and then air dry. Do not touch with fingers after cleaning. Be sure the variable capacitor does not contact the collector. Be sure the plate lead from V1 is soldered to the collector and not touching any other part. Note: Dirty insulators or high resistance shorts in this assembly may cause leakage currents that result in off-scale readings.

c. Low Range Auxiliary Removal, Repair and Replacement - The low range accessory and probe consists of two main parts: A G-M tube housing (forward end) and an electronic circuitry housing (handle end). The circuitry housing is sealed and should not be disassembled in the field.

(1) Unscrew four 6-32 captive screws from top plate and withdraw chassis from housing. See Figure 5-5.

(2) To replace G-M tube, V1, unscrew end window cover assembly from end of probe (Figure 5-6). Pry up tube using screwdriver under the mica window flange. Save insulating washer and rubber "O" ring and reuse on new tube. Insert new tube until anode cap is seated in its clamp. Slight upward or spring pressure should be felt. This is the action of the cathode contact springs.

CAUTION

This is a thin wall tube that can be damaged by heavy handling. Hold by mica window flange.

(3) Probe circuitry disassembly should only be undertaken when it is definitely established that a fault in the "driver" pulse or G-M tube output signal circuits exists. Remove V1 as in (2) above. Remove the 2-56 grounding screw toward the rear of the probe (D in Figure 5-7). Cut and peel the RTV from the rear of probe. The circuit assembly should now be free to slide out the rear. A 1/4 inch diameter rod seated in the anode clip may be used to facilitate removal. Do not use excessive force as the anode clip insulator may be damaged.

d. Battery Charger - The charger is a completely potted unit and not intended to be repaired at any maintenance level. Routine maintenance should be limited to cleaning of the battery terminals and inspection of the power cord and low voltage charging cables.

5-4. CALIBRATION

a. General - Although Radiac Set AN/PDR-63 was calibrated when manufactured, it should be submitted at least once every six-months to an authorized radiac repair facility for recalibration and maintenance. End users should not attempt to calibrate or repair the subject equipment unless authorized. Calibration is accomplished first by correct alignment of the electronics and then by exposure to known field strengths of gamma radiation. Calibration is valid only for a given set. The calibration adjustment depends on the particular high range radiacmeter to which the accessory is attached; if the

. range unit is changed, the accessory must be
alibrated.

. Test Equipment - The equipment outlined in le 5-1 is sufficient for calibrating Radiac Set 'PDR-63. If a source of radiation other than an 'UDM-1A is available, the following formula may sed to establish various field intensities for bration:

$$D = \sqrt{\frac{(mc)\quad(k)}{(r/hour)}}$$

where:

D = the required distance in centimeters
mc = the source strength in millicuries
r/hr = the desired field intensity
k = the emission constant depending on the source used. See Table 5-3.

WARNING

Observe all safety regulations and precautions when handling radioactive materials.

TABLE 5-3. EMISSION CONSTANTS FOR CALIBRATION SOURCES

SOURCE	CONSTANT K
Cobalt 60	13.5
Cesium - 137	3.2

c. High Range Unit, IM-226/PDR-63 - Normally unit should only require a source calibration; vever, if 1A1Q1 or 1A1T1 or 1Z1 is replaced,

1A1R3 which limits Q1 collector current must be reset. Proceed as follows:

(1) Open unit as in paragraph 5-3a.

(2) Unsolder one end of shorting jumper acros[illegible] Jx and Tack solder 1 ohm across Rx (Figure 5-8).

(3) Connect the test equipment as shown in Figure 5-8. Set the Pulse Generator to zero or minimum amplitude at a frequency of 60 pps.. Set th[illegible] Oscilloscope for 50 mv/cm vertical sensitivity and 50 microsecond/cm horizontal sweep.

(4) Turn the Range Switch to 1000 rad/hr.

(5) Starting from zero, slowly increase the generator pulse amplitude until the radiac meter [illegible] upscale. The meter should indicate between 100 an[illegible] 200 rad/hr.

(6) The waveform on the oscilloscope shou[illegible] as shown in Figure 5-9. If not, adjust 1A1R3 for [illegible] peak current of 130 ma (130 mv on the scope).

(7) Turn the Range Switch to OFF remove Rx and resolder jumper Jx.

(8) Reassemble unit.

(9) Source Calibration - Using an AN/UDM-1 or 1A or any equivalent calibrator of suitable stren[illegible] to produce 100 r/hr at one meter, align the high range unit such that the long axis of the ion chambe[illegible] is at right angles to the beam of radiation (meter u[illegible] and range switch knob side toward source).

(a) Position center of ion chamber (2-1/8-[illegible] inch from forward extremity of case) in the center[illegible] of beam at a distance preferably for a mid to 80% [illegible] full scale reading on the 0-100 rad/hr range. If a[illegible] reading on this range is not possible, calibration c[illegible] be performed on the 0-10 rad/hr range.

(b) For a midscale calibration, assume th[illegible] 51 r/hr yields 50 rad/hr. (A dose of 1 r implies a[illegible] absorbed dose of about 93 to 98 ergs per gram of s[illegible] tissue, or 0.93 to 0.98 rad in the range of photon energies from 0.3 to 3 mev).

(c) Remove seal screw from CAL port (E in igure 5-2) and, using a small screwdriver, adjust 1R4 for correct meter reading.

d. Skin Dose Unit, DT-508/PDR-63 - Source alibration:

(1) Connect the skin dose accessory to the high ange unit and turn the range switch to the 0-5 C (500) ad/hr range.

(2) Align the probe such that the beta window unmasked or unshielded) is perpendicular to and oward the source.

(3) Again, assuming a 98% yield, position the robe in a 255 r/hr field and adjust the CAL screw on ne face opposite the window for the correct meter ading of 250 rad/hr.

e. Low Range Unit, DT-507/PDR-63 - Normally ne unit should only require a source calibration; owever, if any major components affecting the driver pulse or power supply have been replaced, nen the pulse width and repetition rate controls A2A1R12 and R5 respectively as well as the high oltage controls 2A2A1R3 and R4 should be readjusted. roceed as follows:

(1) Withdraw the low range auxiliary as outlined n paragraph 5-3, c, (1).

(2) Remove the G-M tube, V1 as outlined in aragraph 5-3, c, (2).

(3) Connect the low range auxiliary to the high ange unit.

(4) Connect the oscilloscope,(See Fig. 4-7 page 3), the G-M tube anode socket in the probe assembly. et the scope for AC input, 50 v/cm vertical sen- itivity and 100 microsecond/cm horizontal sweep.

(5) Connect the high side of the 0-1000 V lectrostatic VM to the junction of 2A2A1C9 and R9 TP-4 in Figure 4-7).

(6) Turn the range switch to the 0-1000 mrad/ r range.

(7) Adjust 2A2A1R3 for 550 to 560 V.

(8) Adjust 2A2A1R5 for a "driver" pulse period of 800 microseconds.

(9) Change the scope sweep to 1 microsecond/cm and adjust 2A2A1R12 for an average pulse width of 7 microseconds. See Figure 5-10.

(10) There is interaction between all three controls, so repeat steps (7), (8), and (9) until proper settings are obtained.

(11) Turn the range switch to the 0-10 mrad/hr range. The "driver" pulse amplitude will decrease to approximately 100 V.

(12) Adjust 2A2A1R4 for 700 - 710 V.

(13) Turn the range switch to OFF and reassemble the low range probe. Leave the auxiliary open.

(14) Source Calibration - Calibration of the low range accessory is accomplished principally by a single control. Both beta window shutters should be closed and the probe positioned at right angles to the beam.

(a) Place the probe in a 620 mr/hr field.

(b) Adjust 2A2A1R5 ("driver" pulse repetition rate) for an average meter reading of 600 mrad/hr on the 0-1000 mrad range.

(c) Place the probe in a 62 mr/hr field and turn the range switch to 0-100 mrad/hr.

(d) If the reading does not average 60 ±20%, trim 2A2A1R12 accordingly (clockwise to raise reading Do not adjust R12 more than 2 full turns. The Electrostatic VM should be left in position to see if any significant change in high voltage has occurred as a result of adjusting R5 or R12.

(e) There are no adjustments for the remaining ranges. If it is desired to check the operation, Table 5-4 should be used as a guide.

(f) Lock all potentiometers and reassemble unit. Turn range switch OFF.

TABLE 5-4. LOW RANGE CALIBRATION

Range (mrad/hr)	Source Intensity (mr/hr)	Average Meter Reading (mrad/hr)
0-100	62.5	60 ±20%
0-10	6.25	6 ±30%
0-1	0.625	0.6 ±30%

5-5. PERFORMANCE STANDARDS

a. Waveforms - The waveforms shown alongside the test points on the Servicing Block Diagram of Figure 4-7 are sufficient to define performance standards in an instrument of this complexity.

b. Voltages - Table 5-5 lists the normal circuit voltages obtained with a set of recharged batteries.

5-6. ILLUSTRATIONS

Figures 5-1 through 5-7 show the locations of all the components of Radiac Set, AN/PDR-63. Figures 5-11 through 5-16 contain the complete schematic and wiring diagrams of the units.

TABLE 5-5. NORMAL CIRCUIT VOLTAGES

UNIT	SEMI-CONDUCTOR	D. C. VOLTAGES E	B	C	ANODE	CATHODE	MEASURED TO:
1	Q1	2.4	3.3	0			Gnd
Note 1	CR3				—	120	Gnd
	CR4				120	350	Gnd
	CR5				350	*500	Gnd
2	Q1	2.5	3.1	0.2			Gnd
Note 2	Q2	0	0.6	1.9			Gnd
	Q3	-11.5	-12	-38			Gnd
	Q4	1.8	2.4	2.5			Gnd
	CR1				-17.5	0.4	Gnd
	CR2				-19	-17.5	Gnd
	CR3				-38	-19	Gnd
	CR4				-50	—	Gnd
	CR5				—	*510	Gnd
	CR6				*510	*560	Gnd
	CR7				—	—	Gnd
	CR8				—	11.7	CR8 Anode

Voltages measured with multimeter specified in Table 5-1.
Note 1: High range operating in BATT
Note 2: Low range operating on 0-1000 mrad/hr. *Electrostatic Vm used

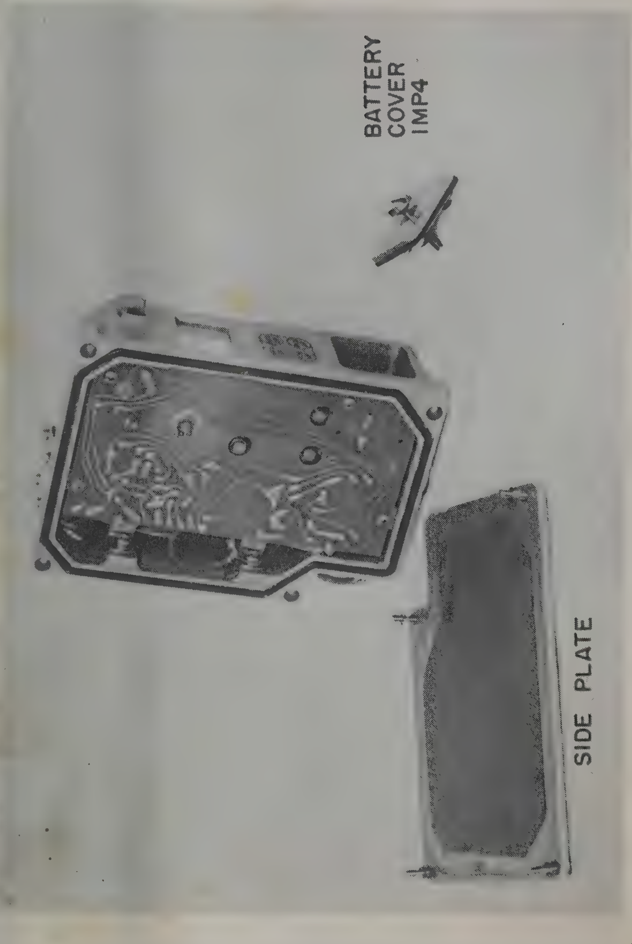


Figure 5-1. High Range Unit

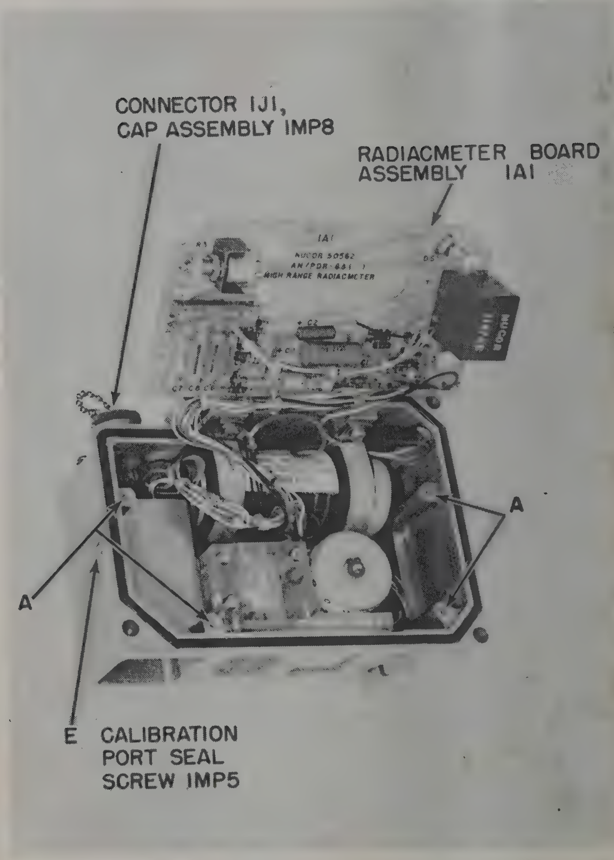


Figure 5-2. High Range Unit, A1 Board Removal

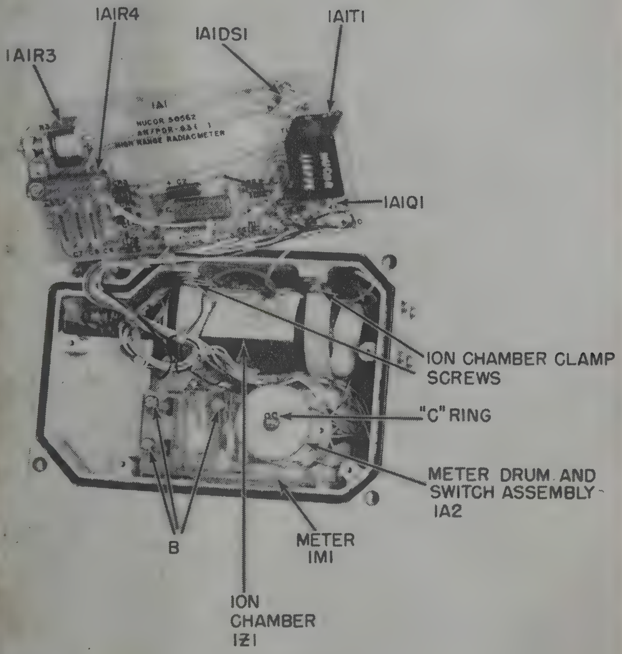


Figure 5-3. High Range Unit, Interior Parts Removal

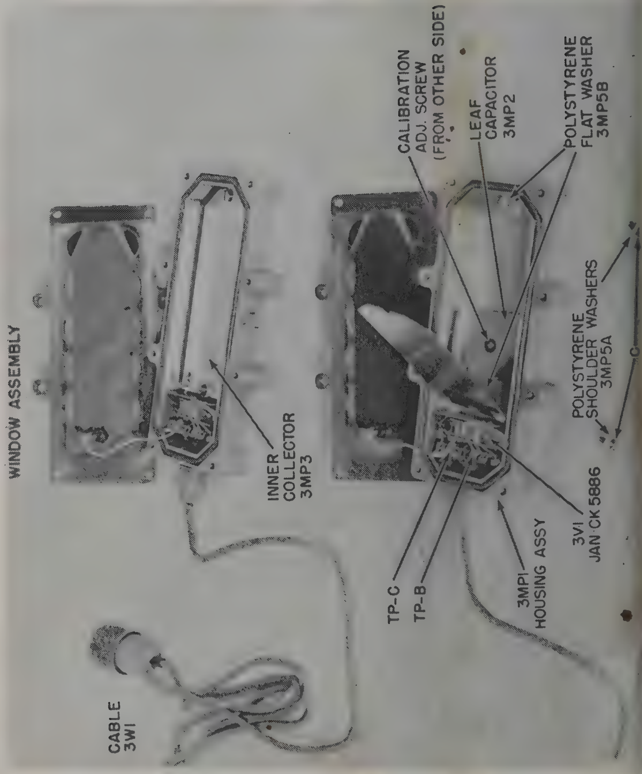


Figure 5-4. Skin Dose Probe Disassembled

Figure 5-5. Low Range Auxiliary

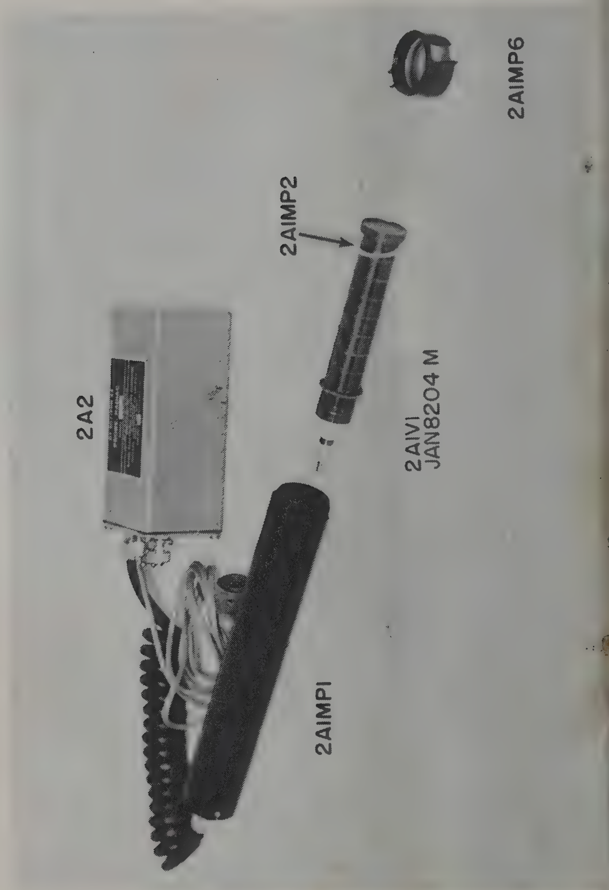


Figure 5-6. Low Range Probe, GM Tube Replacement

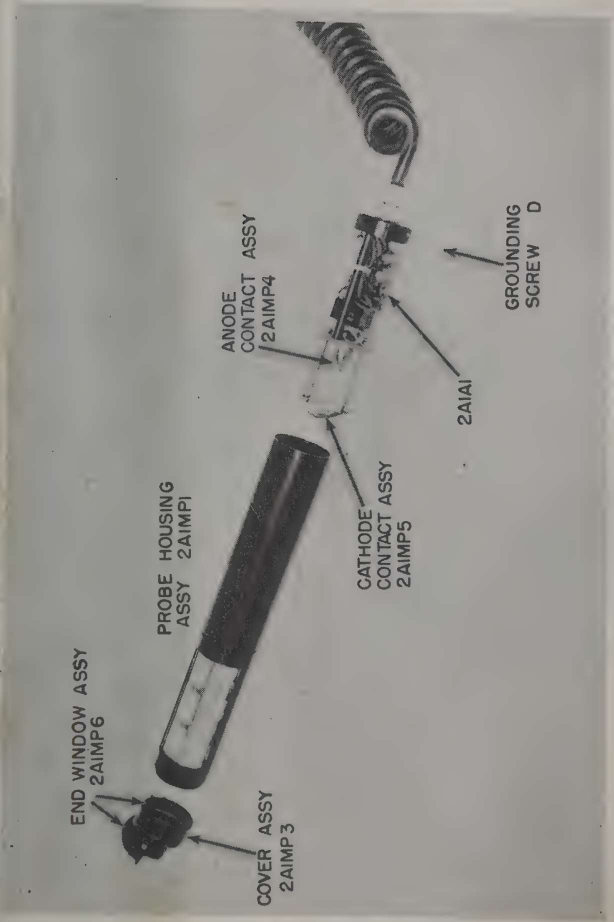


Figure 5-7. Probe Disassembly

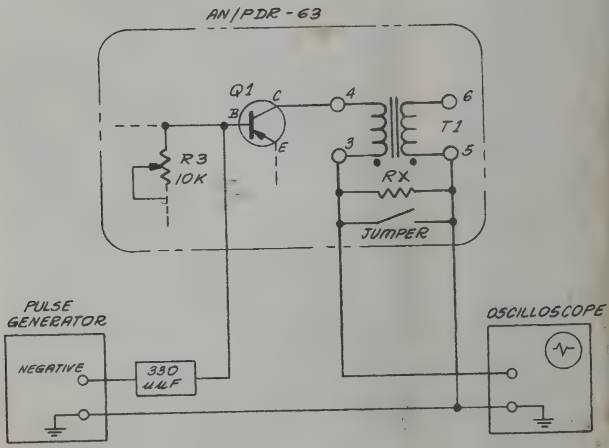


Figure 5-8. Test Set-up for Adjustment of 1A1R3

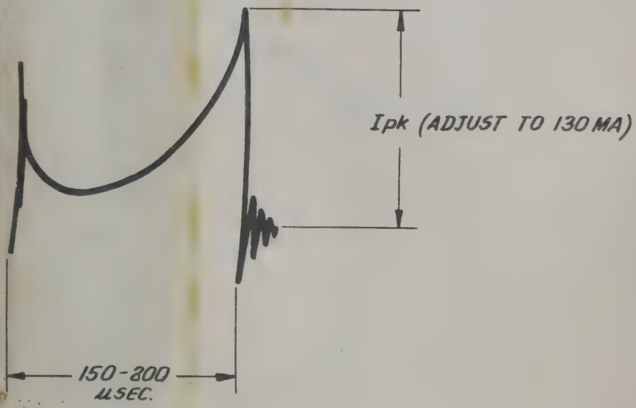


Figure 5-9. Transistor 1A1Q1 Collector Current Waveform

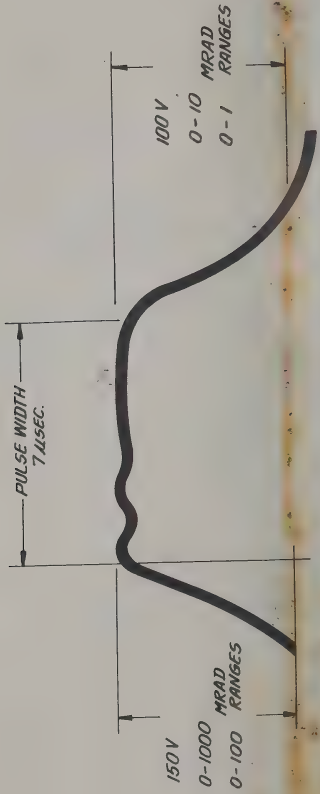


Figure 5-10. Driver Pulse Waveform at G-M Anode Socket

Figure
5-11

NOTES

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS.
2. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS.
3. PARTIAL REFERENCE DESIGNATION ARE SHOWN, PREFIX DESIGNATIONS WITH ASSEMBLY DESIGNATION.
4. SWITCH SECTIONS ARE SHOWN AS VIEWED FROM FRONT OR KNOB END WITH SWITCH IN EXTREME COUNTER CLOCKWISE (OFF) POSITION.
5. RT2 IN PARALLEL WITH R7 MUST BE SELECTED SUCH THAT THE TOTAL METER CIRCUIT RESISTANCE EQUALS 6130 OHMS I.E.

$$RM1 + \frac{R6\,RT1}{R6+RT1} + \frac{R7\,RT2}{R7+RT2} = 6130 \text{ OHMS} \pm 5\%$$

S2 SWITCH POSITIONS

1 - OFF
2 - BATT
3 - 1000 RAD/HR ┐
4 - 100 RAD/HR ├ DEEP DOSE
5 - 10 RAD/HR ┘
6 - 5000 RAD/HR ┐
7 - 500 RAD/HR ┘ SKIN DOSE PROBE
8 - 1000 MRAD/HR ┐
9 - 100 MRAD/HR │
10 - 10 MRAD/HR ├ LOW RANGE ACCESSORY
11 - 1 MRAD/HR ┘

OBE

HR
HR
HR — LOW RANGE ACC.
HR
PROBE

UNIT 1 HIGH-RANGE RADIACMETER

High Range Radiacmeter, R-63 Schematic Diagram

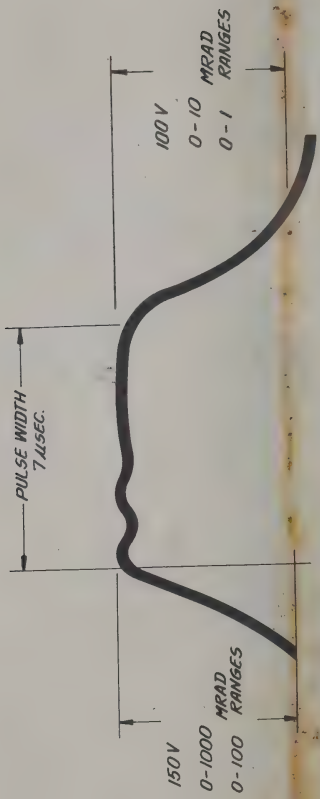


Figure 5-10. Driver Pulse Waveform at G-M Anode Socket

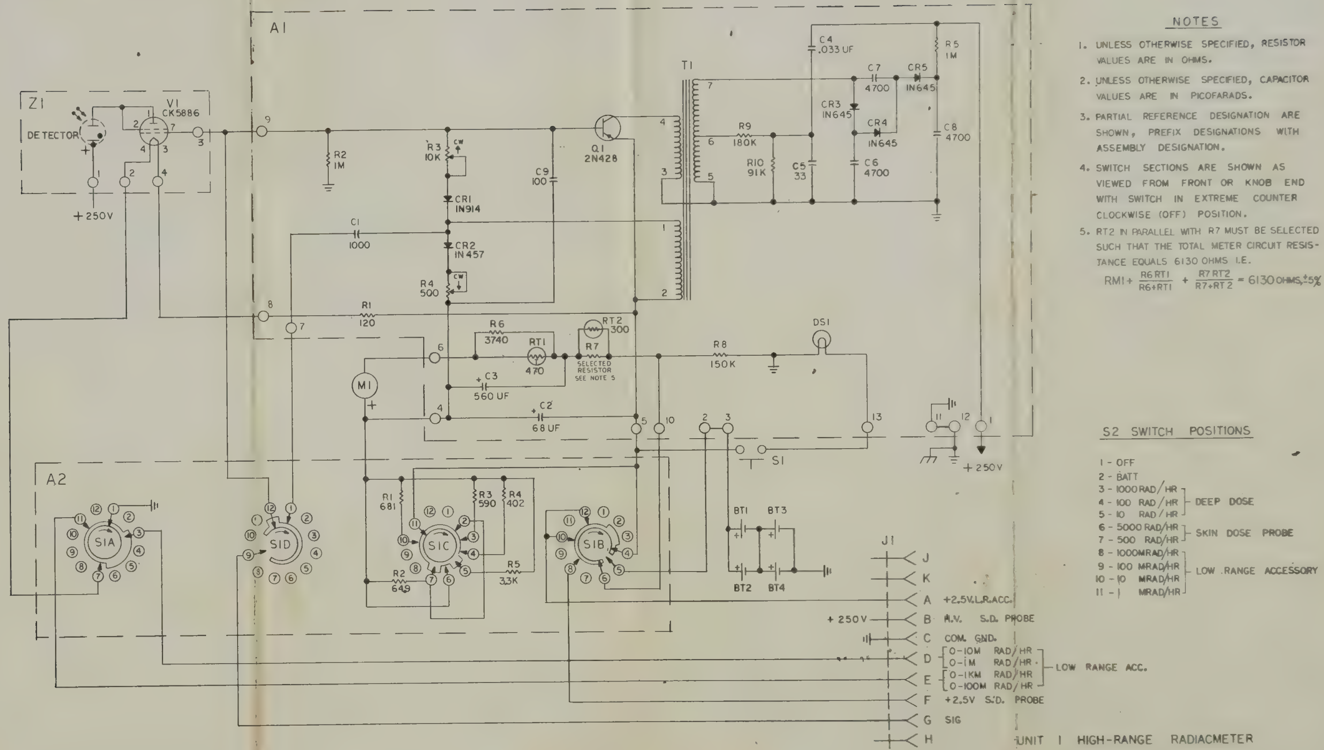
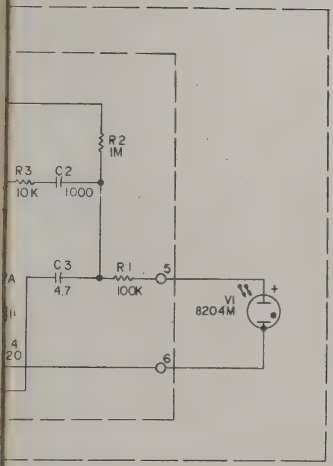


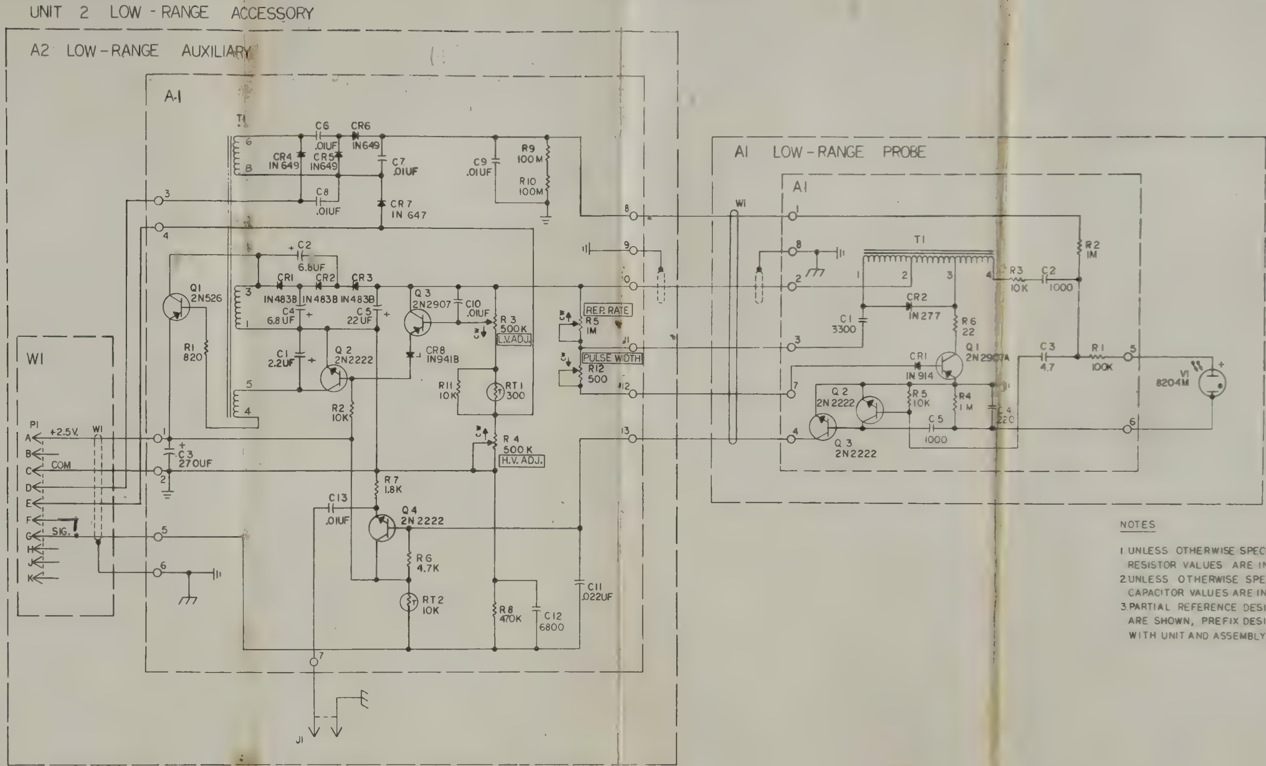
Figure 5-11. High Range Radiacmeter, IM-226/PDR-63 Schematic Diagram



NOTES

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS.
2. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS.
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, PREFIX DESIGNATIONS WITH UNIT AND ASSEMBLY DESIGNATION.

-12. Low Range Auxiliary,
PDR-63 Schematic Diagram



NOTES

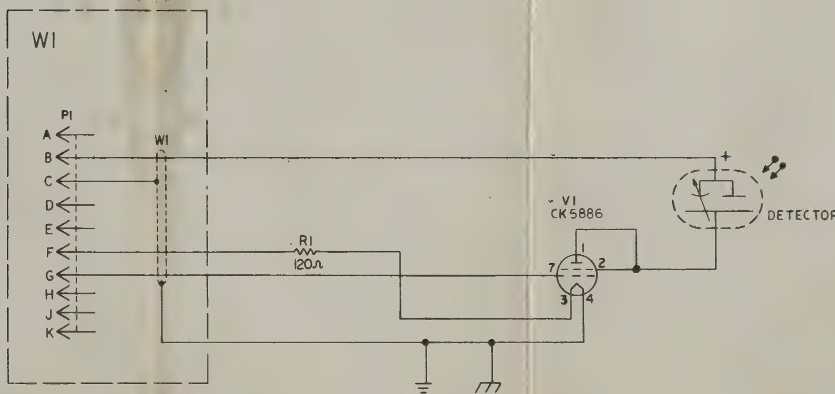
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS
2. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, PREFIX DESIGNATIONS WITH UNIT AND ASSEMBLY DESIGNATION.

Figure 5-12. Low Range Auxiliary, IM-226/PDR-63 Schematic Diagram

TES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, PREFIX DESIGNATIONS WITH UNIT & ASSEMBLY DESIGNATION.

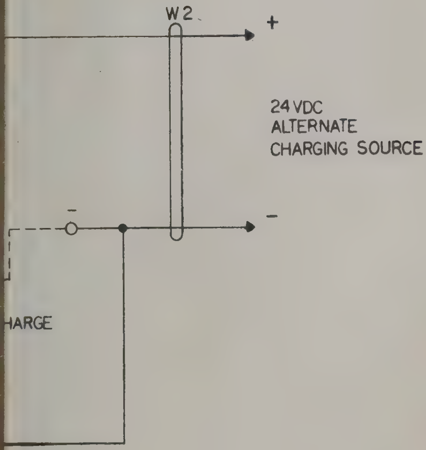
UNIT 3 SKIN - DOSE ACCESSORY



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, PREFIX DESIGNATIONS WITH UNIT & ASSEMBLY DESIGNATION.

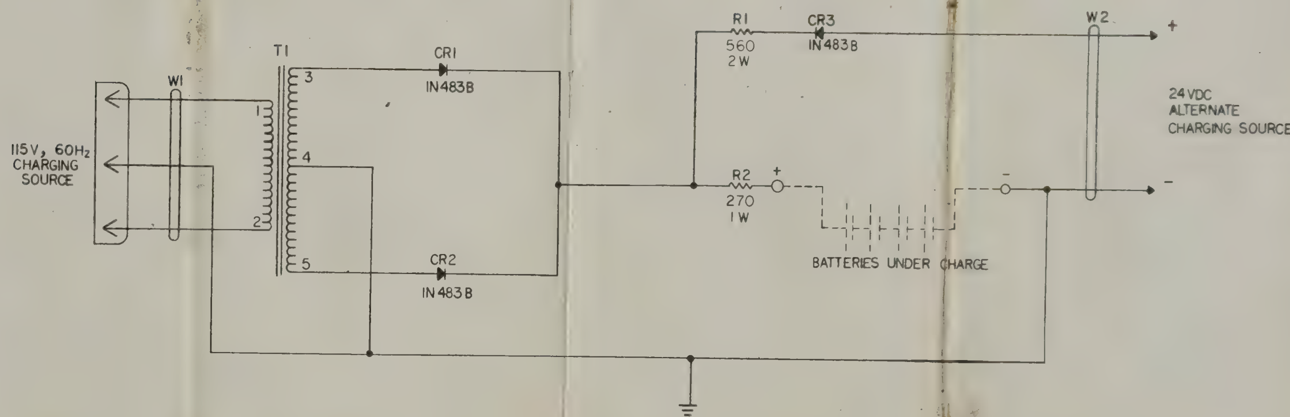
Figure 5-13. Skin Dose Accessory (Sheet 1 of 2)



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, PREFIX DESIGNATIONS WITH UNIT NUMBER.

UNIT 4 BATTERY CHARGER



NOTES:

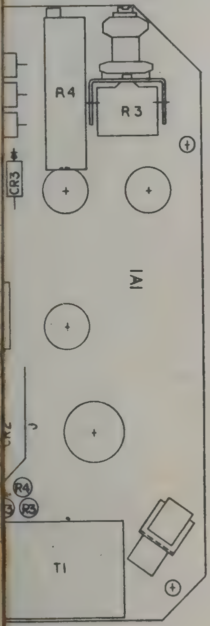
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, PREFIX DESIGNATIONS WITH UNIT NUMBER.

Figure 5-13. Battery Charger (Sheet 2 of 2)

N AL

Figure
5-14

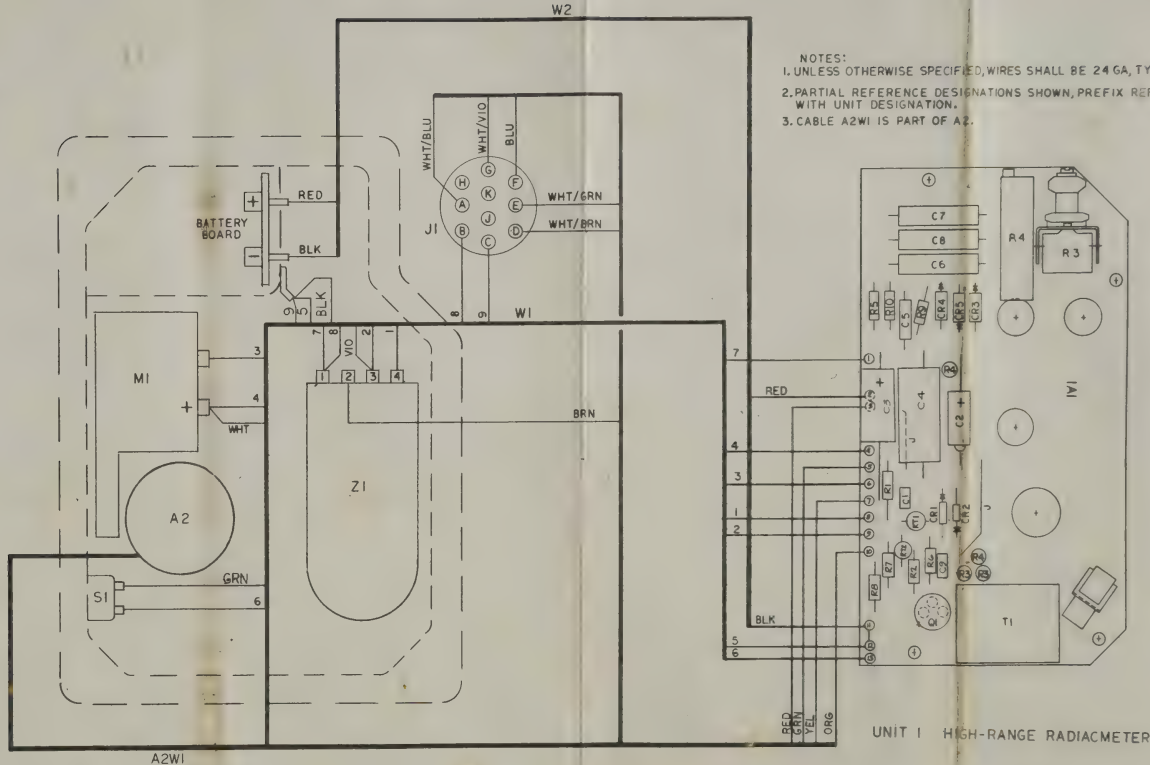
D, WIRES SHALL BE 24 GA, TYPE E PER MIL-W-16878.
NATIONS SHOWN, PREFIX REFERENCE DESIGNATION



H-RANGE RADIACMETER

14. High Range Radiacmeter
Wiring Diagram

N AL



NOTES:
1. UNLESS OTHERWISE SPECIFIED, WIRES SHALL BE 24 GA, TYPE E PER MIL-W-16878.
2. PARTIAL REFERENCE DESIGNATIONS SHOWN, PREFIX REFERENCE DESIGNATION WITH UNIT DESIGNATION.
3. CABLE A2W1 IS PART OF A2.

Figure 5-14. High Range Radiacmeter Wiring Diagram

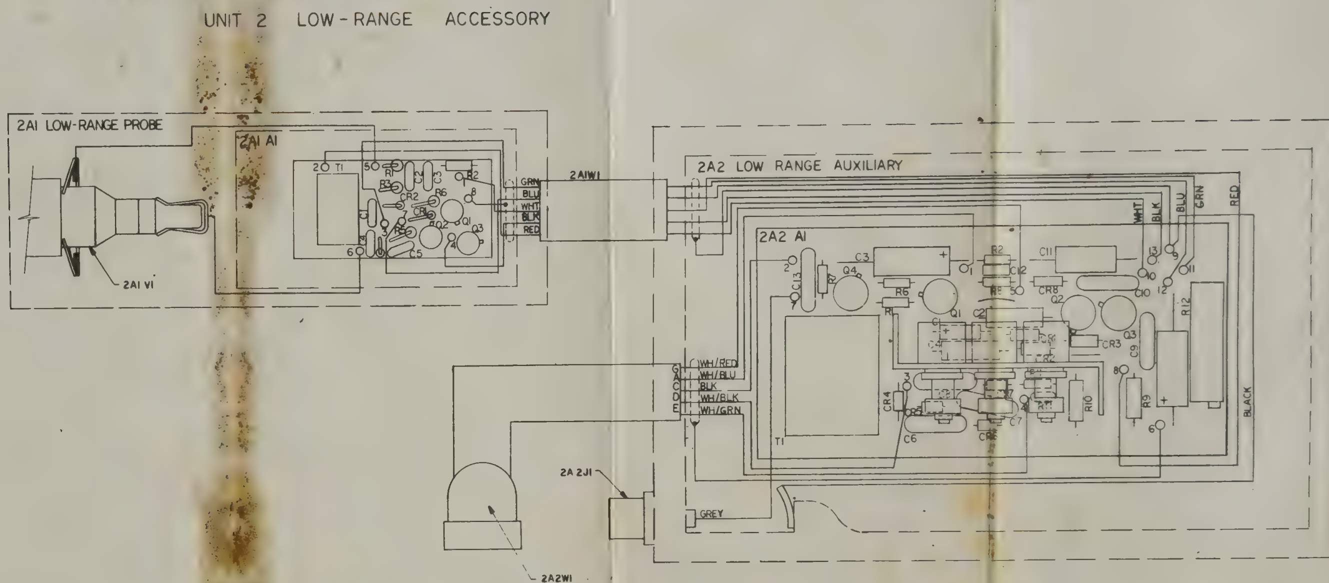
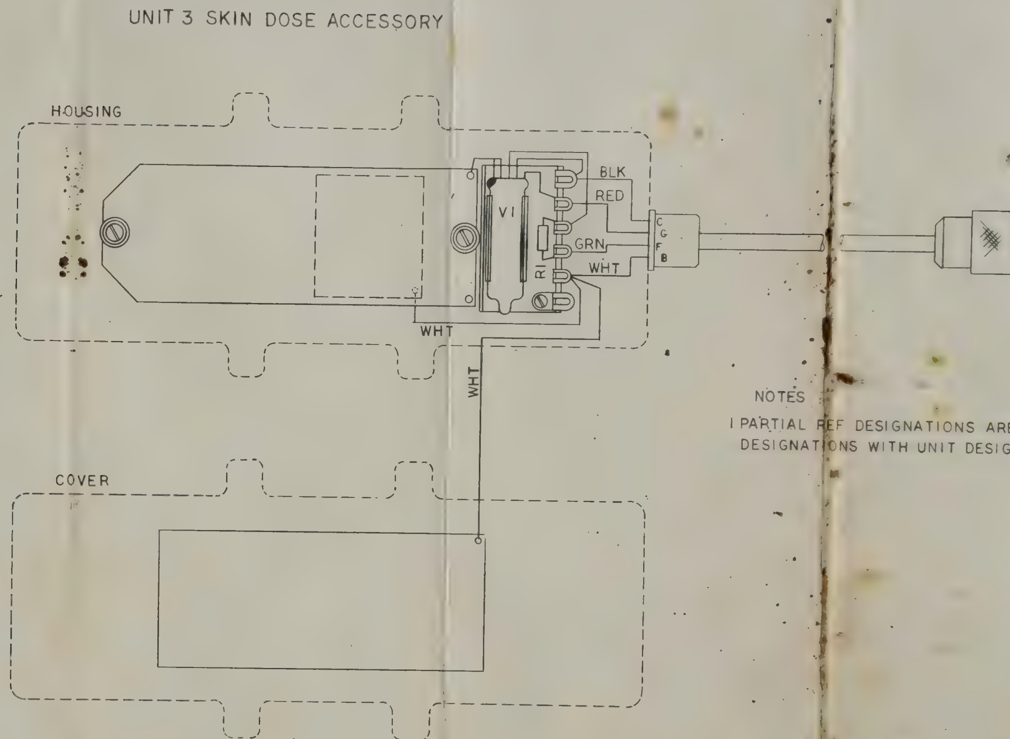


Figure 5-15. Low Range Accessory Wiring Diagram



NOTES

1 PARTIAL REF DESIGNATIONS ARE SHOWN PREFIX DESIGNATIONS WITH UNIT DESIGNATION

Figure 5-16. Skin Dose Accessory Wiring Diagram

SECTION 6

PARTS LIST

6-1. INTRODUCTION

a. Reference Designations - The unit numbering method of assigning reference designations has been used to identify units, assemblies, subassemblies and parts. Examples of this numbering method are as follows:

(1) 1J1 which is read as the first connector (J) of the first unit.

(2) 2A2R6 which is read as the sixth resistor (R) of the second assembly (A) of the second unit.

b. Reference Designation Prefix - Partial reference designations are used on the equipment and illustrations for simplicity. When referring to or ordering parts, the complete reference designation should be used and may be obtained by placing the proper unit and assembly prefix before the partial designation.

6-2. LIST OF UNITS

Table 6-1 is a listing of the units comprising iac Set AN/PDR-63 and a reference to the page h best illustrates it.

3. MAINTENANCE PARTS LIST

Table 6-2 lists all the units and their maintenance s. The units are listed in numerical sequence. intenance parts are listed alpha-numerically in umn 1 by class of part following the unit designa- Column 2 provides the noun-name and a brief

description where necessary. Preferred parts are listed only by their specified nomenclature. Colun 4 refers to the figure which best illustrates the par

TABLE 6-1. LIST OF UNITS

UNIT NO.	QTY	NAME OF UNIT	DESIGNATION	COLLOQUIAL NAME	PAGE
1	1	High Range Radiacmeter	IM-226/PDR-63	High Range Unit High Range Module	6-3 to 6-6
2	1	Low Range Accessory	DT-507/PDR-63	Low Range Unit Low Range Probe	6-6 to 6-11
3	1	Skin Dose Accessory	DT-508/PDR-63	Skin Dose Unit Skin Dose Probe	6-11, 6-12
4	1	Battery Charger	PP-6597/PDR-63	Charger	6-12, 6-13

TABLE 6-2. MAINTENANCE PARTS LIST

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
		RADIAC SET AN/PDR-63: Mfr. 06442	1-0
1		HIGH RANGE RADIACMETER, IM-226/PDR-63: Mfr 06442, dwg. D-91149-1	3-1
1BT1	1	BATTERY, RECHARGEABLE: Size AA, mfr 19209, type 41B905AA26G-2	2-2
1BT2	1	BATTERY, RECHARGEABLE: Size AA, mfr 19209, type 41B905AA26G-2	2-2
1BT3	1	BATTERY, RECHARGEABLE: Size AA, mfr 19209, type 41B905AA26G-2	2-2
1BT4	1	BATTERY, RECHARGEABLE: Size AA, mfr 19209, type 41B905AA26G2	2-2
1J1		CONNECTOR: MIL type MS 3112E12-10S	5-2
1M1		METER: Mfr 06442, dwg. B11868	5-3
1MP1		WINDOW, METER: Mfr 06442, dwg. 20668	3-1
2		KNOB, SWITCH: Mfr 06442, dwg. 20669	3-1
[illegible]		CLAMP, ION CHAMBER: Mfr 06442, dwg. 11796	5-3
4		COVER, BATT. BOX ASSY: Mfr 06442, dwg 11950	5-1
5		SCREW, SEAL: Mfr 06442, dwg. 11801	5-2
6		SWITCH, BOOT: Mfr 97539, type N5045	3-1

TABLE 6-2. (Continued)

REF DESIG	NOTES	NAME AND DESCRIPTION	
1MP7		COVER, SHIELD, ASSY: Mfr 06442, dwg. 20703	3-
1MP8		CONNECTOR, CAP, ASSY: Mfr 06442, dwg. 11805	5-
1MP9		WASHER: Mfr 06442, dwg 20676	5-
1MP10		O-RING: Mfr 06442, dwg 60619	5-
1S1		SWITCH, PUSH BUTTON: Mfr 81073, type 39-1	3-
1Z1		ION CHAMBER, GAMMA: Mfr 06442, dwg. 11878	5-
1A1		ASSEMBLY, RADIACMETER BOARD: Mfr 06442, dwg. 50562	5
1A1C1		CAPACITOR: MIL type CK05BX102M	5-1
1A1C2		CAPACITOR: MIL type CL65BB680MP3	5-1
1A1C3		CAPACITOR: MIL type CL65BB561MP3	5-14
1A1C4		CAPACITOR: MIL type CQ09A1KE333K1	5-1
1A1C5		CAPACITOR: MIL type CY10C330K	5
1A1C6		CAPACITOR: MIL type CY20C472K	
1A1C7		CAPACITOR: MIL type CY20C472K	
1A1C8		CAPACITOR: MIL type CY20C472K	5 -
1A1C9		CAPACITOR: MIL type CK60BX101KM	5-1

TABLE 6-2. (Continued)

EF SIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
CR1		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N914	5-14
CR2		SEMICONDUCTOR DEVICE, DIODE: MIL type JAN1N457	5-14
CR3		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N645	5-14
DS1		LAMP, INCANDESCENT: Mfr 08806, type 338	5-14
Q1		SEMICONDUCTOR DEVICE, TRANSISTOR: MIL type 2N428	5-14
R1		RESISTOR: MIL type RC07GF121K	5-14
R2		RESISTOR: MIL type RC07GF105K	5-14
R3		RESISTOR: MIL type RV6LAYSA103B	5-14
R4		RESISTOR: MIL type RT12C2L501	5-14
R5		RESISTOR: MIL type RC07GF105K	5-14
[illegible]		RESISTOR: MIL type RN60D3741F	5-14
[illegible]		RESISTOR: SELECTED: Mfr 06442, dwg D-91149	5-14
[illegible]		RESISTOR: MIL type RN55D1503F	5-14
[illegible]		RESISTOR: MIL type RC07GF184J	5-14
10		RESISTOR: MIL type RC07GF913J	5-14
1		THERMISTOR: Mfr 06442, dwg B 20772	5-14

TABLE 6-2. (Continued)

REF DESIG	NOTES	NAME AND DESCRIPTI
1A1RT2		THERMISTOR: MIL typ RTH06AS3000J
1A1T1		TRANSFORMER, PULSE Mfr 06442, dwg. 1187
1A2		SWITCH, ASSY: Mfr 06442, dwg. 1187
1A2R1		RESISTOR: MIL ty RN55C6810F
1A2R2		RESISTOR: MIL type RN55C64R9F
1A2R3		RESISTOR: MIL type RN55C5900F
1A2R4		RESISTOR: MIL type RN55C4020F
1A2R5		RESISTOR: MIL type RC07GF332J
1A2S1		SWITCH, ROTARY: Mf 06442, dwg. 11872
2		LOW RANGE AUXILI DT-507/PDR-63: Mfr 06442, dwg. D-91149-
2A1		LOW RANGE PROBE, ASSY: Mfr 06442, dwg. D-91149-2
2A1MP1		PROBE HOUSING ASSY: Mfr 06442, dwg. 50588
2A1MP2		RING, SPACER: Mfr 06442, dwg. 20665
2A1MP3		DETECTOR CAP ASSY: Mfr 06442, dwg. 11952
2A1MP4		ANODE CONTACT ASSY: Mfr 06442, dwg. 11953

TABLE 6-2. (Continued)

	NOTES	NAME AND DESCRIPTION	FIG. NO.
5		CATHOD CONTACT ASSY: Mfr 06442, dwg. 11954	5-7
		END WINDOW COVER ASSY: Mfr 06442, dwg 11787	5-7
7		O-RING: Mfr 06442, dwg 11788	5-6
	GM Tube	TUBE, ELECTRON: MIL type 8204M	5-6
		CABLE, COIL CORD: Mfr 06442, dwg. 41174	5-5
		ASSEMBLY, PROBE BOARD: Mfr 06442, dwg. 11864	5-7
C1		CAPACITOR: MIL type CK06BX332K	5-15
		CAPACITOR: MIL type CK60AX102M	5-15
3		CAPACITOR: MIL type CK60BX4R7K	5-15
4		CAPACITOR: MIL type CK05BX221M	5-15
		CAPACITOR: MIL type CK05BX102M	5-15
R1		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N914	5-15
R2		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N277	5-15
Q1		SEMICONDUCTOR DEVICE, TRANSISTOR: MIL type 2N2907A	5-15

TABLE 6-2. (Continued)

REF DESIG	NOTES	NAME AND DESCRIPTION
2A1A1Q2		SEMICONDUCTOR DEVICE, TRANSISTOR: MIL type 2N2222
2A1A1Q3		SEMICONDUCTOR DEVICE, TRANSISTOR: MIL type 2N2222
2A1A1R1		RESISTOR: MIL type RC07GF104K
2A1A1R2		RESISTOR: MIL type RC07GF105K
2A1A1R3		RESISTOR: MIL type RC07GF103K
2A1A1R4		RESISTOR: MIL type RC07GF105K
2A1A1R5		RESISTOR: MIL type RC07GF103K
2A1A1R6		RESISTOR: MIL type RC07GF220K
2A1A1T1		TRANSFORMER, PULSE: Mfr 06442, dwg. 11865
2A2		LOW RANGE AUX. HSG, Mfr 06442, dwg D-91149
2A2J1		CONNECTOR: MIL type UG-625B/U
2A2MP1		COVER ASSY: Mfr 06442, dwg. 11951
2A2W1		CABLE ASSY: Mfr 06442, dwg 41274
2A2A1		ASSEMBLY, AUXILIARY BOARD: Mfr 06442, dwg 33963
2A2A1C1		CAPACITOR: MIL type CS13BE225M

TABLE 6-2. (Continued)

RF G	NOTES	NAME AND DESCRIPTION	FIG. NO.
A1C2		CAPACITOR: MIL type CS13BF685M	5-15
2A1C3		CAPACITOR: MIL type CL65BB271MP3	5-15
2A1C4		CAPACITOR: MIL type CS13BF685M	5-15
C5		CAPACITOR: MIL type CL65BN220MP3	5-15
1C6		CAPACITOR: MIL type CK63AY103M	5-15
C7		CAPACITOR: MIL type CK63AY103M	5-15
8		CAPACITOR: MIL type CK63AY103M	5-15
C9		CAPACITOR: MIL type CK63AY103M	5-15
C10		CAPACITOR: MIL type CK63AX103M	5-15
C11		CAPACITOR: MIL type CQ09A1MA223J3	5-15
C12		CAPACITOR: MIL type CK06CW682M	5-15
3		CAPACITOR: MIL type CK63AX103M	5-15
R1		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N483B	5-15
R2		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N483B	5-15
CR3		SEMICONDUCTOR DEVICE, DIODE: MIL type 1N483B	5-15

TABLE 6-2. (Continued)

REF DESIG	NOTES	NAME AND DESCRIPTION
2A2A1CR4		SEMICONDUCTOR DE- VICE, DIODE: MIL type 1N649
2A2A1CR5		SEMICONDUCTOR DE VICE, DIODE: MIL typ 1N649
2A2A1CR6		SEMICONDUCTOR DE- VICE, DIODE: MIL type 1N649
2A2A1CR7		SEMICONDUCTOR DE- VICE, DIODE: MIL type 1N647
2A2A1CR8		SEMICONDUCTOR DE- VICE, DIODE: MIL type 1N941B
2A2A1CR9		SEMICONDUCTOR DE- VICE, DIODE: MIL type 1N277
2A2A1Q1		SEMICONDUCTOR DE- VICE, TRANSISTOR: MIL type 2N526
2A2A1Q2		SEMICONDUCTOR DE- VICE, TRANSISTOR: MIL type 2N2222
2A2A1Q3		SEMICONDUCTOR DE- VICE, TRANSISTOR: MIL type 2N2907
2A2A1Q4		SEMICONDUCTOR DE- VICE, TRANSISTOR: MIL type 2N2222
2A2A1R1		RESISTOR: MIL type RC07GF821K

TABLE 6-2. (Continued)

R... G	NOTES	NAME AND DESCRIPTION	FIG. NO.
A1R2		RESISTOR: MIL type RC07GF103K	5-15
A1R3		RESISTOR: MIL type RV6LAYSA504B	5-15
A2 1R4		RESISTOR: MIL type RV6LAYSA504B	5-15
1R5		RESISTOR: MIL type RV6LAYSA105B	5-15
1R6		RESISTOR: MIL type RC07GF472K	5-15
1R7		RESISTOR: MIL type RC07GF182K	5-15
R8		RESISTOR: MIL type RC07GF474K	5-15
A R9		RESISTOR: MIL type RC20GF107	5-15
R10		RESISTOR: MIL type RC20GF107	5-15
[illegible]		RESISTOR: MIL type RC07GF103K	5-15
1R12		RESISTOR: MIL type RT12C2L501	5-15
RT1		THERMISTOR: MIL type RTH06AS3000J	5-15
RT2		THERMISTOR: MIL type RTH24BS1002J	5-15
1		TRANSFORMER, PULSE: Mfr 06442, dwg. 11866	5-15
		SKIN DOSE ACCESSORY, DT-508/PDR-63: Mfr 06442, dwg. D-91149-3	3-3

TABLE 6-2. (Continued)

REF DESIG	NOTES	NAME AND DESCRIPTIC[illegible]
3MP1		HOUSING ASSEMBLY: Mfr 06442, dwg. 505[illegible]
3MP2		CAPACITOR LEAF: [illegible]fr 06442, dwg. 20677
3MP3		COLLECTOR Inner:M[illegible] 06442, dwg. 41018
3MP4		SCREW, SPECIAL: Mfr 06442, dwg. 11810
3MP5		WASHER, SPECIAL: Mfr 06442, dwg. 20680
3MP6		RING, RETAINER: Mfr 06442, dwg. 20681
3MP7		O-RING: Mfr 06442 dwg. 11813
3R1		RESISTOR: MIL type RC20GF121K
3V1		TUBE, ELECTRON: MIL type JAN CK5886
3W1		CABLE ASSEMBLY: Mfr 06442, dwg. 34121
4		BATTERY CHARGER, PP-6597/PDR-63: Mfr 06442, dwg. D-91149-4
4CR1	2	SEMICONDUCTOR DEVICE, DIODE: MIL type 1N483B
4CR2	2	SEMICONDUCTOR DEVICE, DIODE: MIL type 1N483B
4CR3	2	SEMICONDUCTOR DEVICE, DIODE: MIL ty[illegible] 1N483B